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U.S. Department of
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Highway Saf

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This issue of Highway Safety Literature begins the publication of original articles by staff members and other contributors. The first of this series—presented in the interest of making the collections of the Technical Reference Branch more widely known to researchers—appears at the back of the journal. We would appreciate receiving your comments on this new feature and any suggestions for the improvement of *HSL*.

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ABSTRACT C

guidelines are suggested which will aid in the efficient transmission of power through the bearings. An experiment was devised to establish what proportion of mechanical losses in an automotive engine is absorbed by the bearings. A hydraulic dynamometer, a Daimler Benz M110 6 cylinder gasoline engine as a "slave" engine, and a Vauxhall Viva 4 cylinder gasoline engine as the "test" engine comprised the test equipment. The equipment was coupled in various forms and tests were run. It was found that 20% of the losses could be attributed to the bearings. Losses associated with valve gear operation, piston movement, and the fan form the major component. The calculation of the viscous friction in a plain bearing is worked out by the following method: calculation of the bearing load cycle; calculation of the effective viscosity of the oil in the bearing clearance using the mean cyclic load; calculation of the shaft displacement orbit using the effective viscosity; and calculation of the viscous friction from the given equation using the mean cyclic shaft displacement and the effective viscosity. The calculations are shown to give reasonable agreement with the experimental results. Bearing clearance is seen to have a complex relationship with viscous friction. Tight clearances give high losses, but very large clearances can lead to excessive "churning" losses in the crankcase. The influence of oil type cannot be easily estimated. The complex behavior of the polymer loaded multigrade oils requires a different analytical treatment. The overall bearing layout, such as the number of crankshaft supports, was found to have the most direct effect on the total bearing friction.

by P. E. Vickery
Vandervell Products Ltd., England
Rept. No. SAE-750052 ; 1975 ; 16p 6refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 039

THE EFFECTS OF CHARGE DILUTION ON COMBUSTION AND ITS IMPROVEMENT--FLAME PHOTOGRAPH STUDY

A high-speed photographic technique, using an intermittent camera and special treatments for development, is adopted to photograph the weak blue flame peculiar to combustion with exhaust gas recirculation (EGR), so that the effects of some factors on combustion with charge dilution might be studied. Other methods for analyzing combustion phenomena were tried. Multiple ionization probes roughly indicated the pattern of flame propagation, but details of the flame, especially charge dilution, could not be measured by this method. Flame photographs, on the other hand, showed clearly the effects of combustion chamber design on flame propagation and its cyclic dispersion. A single-cylinder, water-cooled, four-cycle, side valve, 27.1 cubic inch engine was used for the flame photograph study. A quartz window was mounted on the

was adjusted in two ways: the fresh, air-fuel ratio was kept constant; and the fresh air and EGR gas to fuel ratio was kept constant. The intake manifold was heated from 149 to 158° F. Camera frame speed was 800 frames per second, and the shutter speed was 1/4000 second. The effects of combustion chamber configuration, ignition energy and spark duration, ignition timing, composition of diluent gas, air-fuel ratio, and mixture homogeneity were examined. Mass burnt fraction was calculated from both flame photographs and pressure indicator diagrams. A combustion chamber having high turbulence and a rich air-fuel ratio promoted the initial flame propagation and flame speed, and improved cyclic dispersion. For high turbulence design, the combustion chamber of a commercial 97.5 cubic inch, 4 cylinder engine was modified. Fluctuation of output torque was measured and analyzed by correlation and probability analyses. This analysis indicated that high turbulence design was effective for improvement of car surge caused by EGR, and this was confirmed by actual driving on the road.

by K. Nakanishi; T. Hirano; T. Inoue; S. Ohigashi
Toyota Motor Co., Ltd., Japan; Univ. of Kyoto, Japan
Rept. No. SAE-750054 ; 1975 ; 12p 14refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 040

THE INFLUENCE OF TRANSIENT CONDITIONS ON THE OPERATION OF AN SI ENGINE, ESPECIALLY WITH RESPECT TO EXHAUST EMISSIONS

An experimental investigation was made to determine if the correlations between emissions and engine operation under steady state conditions are also valid for transient operation. The investigations were based on a test concept whereby as many engine parameters as possible could be varied and preprogrammed in such a way that none of the other parameters would be simultaneously influenced. This concept could be realized by the use of electronic injection and electronic spark timing control. A water-cooled, 4 stroke-cycle otto engine, whose fuel-air ratio and timing have been optimized for each operating point with respect to exhaust emissions, fuel consumption and drivability, was used in the experiment. The engine was accelerated on a test stand and, during acceleration, all essential data were collected and calculated as functions of time. Data were obtained on airflow, fuel injection volume, the mean effective pressure, spark timing, emissions, relative fuel-air ratio, and ignition timing. Results showed that: during acceleration, from a certain operating point, the airflow was lower than under steady-state conditions at the same point; deviations from pre-programmed fuel-air ratios resulted only if the fuel quantity per cycle was not correspondingly changed, as is the case for injection systems controlled by speed and throttle position; under transient conditions the combustion may be slower, corresponding to the lower tem-

of play in the distributor drive, wear in the breaker points, or maladjustments in the speed and vacuum control system.

by K. Zeilinger; A. W. Hussmann
Technical Univ. Munich, Germany
Rept. No. SAE-750053 ; 1975 ; 8p 8refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 041

HIGH PERFORMANCE IGNITION COMPONENTS WITH CELANEX THERMOPLASTIC POLYESTERS

The properties and processing characteristics of celanex thermoplastic polyester, an injection-moldable engineering resin, are reviewed as they relate to ignition component requirements. The resin has high strength and creep resistance, excellent chemical resistance, high temperature resistance, and a very low moisture absorption, yielding excellent electrical properties and superior dimensional stability. The addition of glass fibers greatly enhances physical and thermal properties. A 30% glass fiber reinforced polybutylene terephthalate (GR-PBT) has become most popular. Part and tool design parameters necessary for obtaining optimum results are discussed. A number of ignition components currently in commercial production using glass fiber reinforced Celanex are illustrated, and details are given of some of the testing which preceded the commercial acceptance of the parts. Data are included on the material's performance in a new dielectric durability test, a special long-term test devised specifically to determine the material's capabilities in automotive ignition system service. Test data is also presented to show the superiority of the material over phenolic and alkyd resins in ignition system components.

by Allan G. Serle
Celanese Plastics Co.
Rept. No. SAE-750059 ; 1975 ; 8p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 042

THE GROWTH OF STAMPABLE THERMOPLASTIC SHEET IN AUTOMOTIVE APPLICATIONS

The various process variations and applications of thermoplastics now in use or developing in automotive components are outlined. The combination of materials suppliers, product specifiers, and stamping sources are producing a rapid increase in the use of the process. Process variations include: warm forming; rubber pad forming; diaphragm forming; stretch forming; forging; and billet forming. As the process gains in acceptance, special materials, and equipment or operations are being developed for the stamping of components which have properties required for specific applica-

Rept. No. SAE-750061 ; 1975 ; 4p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 043

BOSS-FASTENER STRENGTHS WITH SMC MATERIALS

The results are presented of a boss-fastener testing program, representing an initial step in determining the boss-fastener strengths possible with a low profile sheet molding compound (SMC), and assessing the dependence of strength on boss-fastener configuration, material composition, and fastener type. With the multitude of available fastener thread types and the wide variation of possible boss configurations, only a limited selection of variables could be evaluated. The speed performance parameters studied were: starting and driving forces of fastener insertion; drive and failure torques; and the axial and lateral strengths of the inserted fastener. Boss shapes were chosen to appraise the strength contributions of fillets and gussets. Fastener selection was restricted to the standard BT and the specialty Hi-Lo thread types. The material selection centered around automotive grade compositions typically used in truck applications. All other parameters which might have influenced performance were set at selected values for all tests. This was necessary to restrict the number of test combinations. In the insertion and failure torque test, the values for axial starting force, axial driving force, driving torque and stripping torque were monitored through a reaction stand on which the boss samples were mounted. The axial and lateral loading tests were performed on a modified Dillon tensile test machine, and developed loads were recorded through a load cell rather than a normal dynamometer. By means of this evaluation those variables which influence boss performance were identified. Of the tests performed, axial drive load, drive torque, and failure torque showed almost complete independence of the variables tested. The only influencing factor was thread type (material strength had some input on drive and failure torque but the controlling factor appears to be I.D., O.D., and thread type). In analyzing the results on axial and lateral loading, it became necessary to determine whether the surrounding laminate was rigid enough to prevent large distortion through flexing. In the case where there was a high amount of distortion, the resultant failure tended to be boss-laminate separation. In this mode, the two controlling factors appeared to be the flexural strength of the material and the boss configuration. In the case where the laminate was held rigid, either by design or external support, the mode of failure was dependent on loading. In axial load, the stud tended to pull from the boss. Its strength was dependent on thread type

HS-017 044

CORRELATION TESTS IN A CLIMATIC WIND-TUNNEL

The first steps are illustrated of full-scale aerodynamic correlation tests in the Volvo Climatic Wind-Tunnel. The knowledge acquired was applied to everyday testing. The scale model testing reported was a summary of the efforts involved in trying to convert the climate tunnel to an acceptable aerodynamic test facility. The aerodynamic properties of the wind-tunnel are presented. The climatic controls used were chosen to give good dynamic response sudden load changes and good static performance. The tunnel measurement system was connected to an IBM 1800 computer which stored and fed back relevant data. The following tests were carried out on a 1972 Volvo 144 sedan on test tracks and in tunnels: a pressure distribution survey to establish a speed, setpoint curve; and force measurements (drag force, full-scale drag force, lift force) taken with the expectation of establishing comparisons between cars at zero yaw angle. The pressure distribution was measured by a 36-tube inclined manometer, drag force by a standard strain-gauge transducer, and lift force with four standard force gauges. In the model testing, a simplified wooden ground-plane was built to carry out the tests determining shape and sizes of the final arrangement. For basic investigation of the flow quality over the ground-plane, the following was measured: velocity profiles; static pressure gradient; and boundary layer growth. Velocity was measured with a traversing pitot-static tube and an inclined micro manometer, turbulence, with a hot-wire anemometer, and boundary layer thickness with a pitot pressure rake connected to a scanivalve. For comparing with the full-scale correlation test, a 1:6 scale model of the same vehicle was prepared. A pressure distribution survey and force measurements were taken. Essential results of the full-scale testing were the set-point and accuracy data for everyday use. A secondary yield was the exploration of the adaptability of the tunnel for other types of testing than were originally intended. The tests with scale models completely altered the first supposition as regards an aerodynamic insert and probably saved time, irrefragable design errors, and money.

by B. Hamsten; F. M. Christensen
AB Volvo
Rept. No. SAE-750064 ; 1975 ; 11p 5refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 045

CORRELATION OF PRESSURE MEASUREMENTS IN MODEL AND FULL-SCALE WIND TUNNELS AND ON THE ROAD

A three-way correlation study of aerodynamic pressure measurements was carried out between the Motor Industry

testing 1000s of about 140 m diameter at each end. The vehicle speed during the measurements was approximately 100 km/h for the five cars and 65 km/h for the one truck. Wind-tunnel measurements for the vehicles were made at a wind speed of approximately 100 km/h, at zero yaw angle. The pressure measurements in the model tunnel were made at a higher wind speed than those at full scale in order to reduce the difference between the respective Reynolds numbers. The tunnel maximum of 45 m/s was used. The models were set up at the ground clearance and attitude corresponding to those of their full-scale counterparts and were tested at the same yaw angles as the latter. The resultant conclusions were: pressure coefficients derived from measurements on vehicles in the full-scale wind tunnel show close correlation with pressure coefficients at the same points in actual road conditions; the form of the pressure distribution is thus faithfully reproduced in the wind tunnel; a good correlation existed between pressure coefficients obtained in full-scale and model tunnels, provided the model and full-scale vehicles were identical in form; the relationship between the reference dynamic head and the effective dynamic head at the vehicle (or model) appeared to be closer than previously assumed, the average correction required for the vehicles in the present tests being over 30% lower than the blockage correction normally used for all vehicle and model tests at MIRA; if the lower correction referred to was applied (in addition to the correction needed for the small velocity deficit in the full-scale tunnel), then the mean relationship of model tunnel, full-scale tunnel, and road measurements of aerodynamic pressures was approximately one-to-one, and a similar relationship would be expected for aerodynamic force measurements; and the use of external static pressure probes attached to the surfaces of full-scale and model vehicles appeared to be largely justified, but flush pressure tappings were considered to be preferable in certain aerodynamically critical areas on models, such as near leading edges where the presence of probes might be expected to disturb the airflow significantly.

by G. W. Carr
Motor Industry Res. Assoc.
Rept. No. SAE-750065 ; 1975 ; 16p 5refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 046

THE WIND TUNNEL'S GROUND PLANE BOUNDARY LAYER—ITS INTERFERENCE WITH THE FLOW UNDERNEATH CARS

In order to determine the best way to simulate a road in a full-scale climatic wind tunnel, a series of comparative tests between road and tunnel have been carried out. The testing covered the following: underbody velocity profiles; pressure distributions; temperatures; and drag coefficients. A VW-K70, a VW 1600 Notchback, and a VW-Porsche 914 were used for the major part of the test program. During all tests in the tunnel and on the road, the springs were kept unblocked. The vehicle position was measured in the tunnel at 90, 120 and 150 km/h and was checked at the lowest velocity on the road. In

both cases, the distance was simply measured with a contact ing rod. No differences between road and tunnel could be determined beyond the accuracy of the road measurement. The underbody velocity profiles were traversed with a pitot static tube. The pressure distribution was measured with pressure tappings drilled into the body. Pressure signals were recorded one after the other with a manometer and a recorder. The wind velocity during all measurements was below 2 m/s. Drag and temperature measurements were also made. Results obtained from the passenger car testing include: good agreement between tunnel and road achieved at the forward probe position with minor deviations near the ground; good agreement between velocity profiles in the tunnel and on the road at the middle probe position; the agreement at the rear position is not as good, however, in the vicinity of the car's underbody, the velocities are identical. For the sports car as well, good agreement of the velocity profiles was found. As with the passenger car, the boundary-layer flow regime is dominated by the displacement flow induced by the body-ground combination. In all three probe positions, velocities measured in the wind tunnel are somewhat higher than on the road, with the exception of the boundary layer on the tunnel floor. The pressure measurements also showed good correlation between tunnel and road for both types of cars. The same was true for the temperatures and, with some care, for the drag coefficient. Despite the efficiency, demonstrated in an earlier test, of boundary-layer suction through a single slot, it was decided not to install such a device in the wind tunnel. It was concluded that the good correlation between road and wind tunnel results did not justify this expense as long as cars with standard ground clearance are tested.

by W. H. Hucho; L. J. Janssen; G. Schwartz
Volkswagenwerk AG (Germany)
Rept. No. SAE-750066; 1975; 12p 19cfs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 047

USE OF NATURAL GAS AS A PRIMARY VEHICULAR FUEL FOR A PUBLIC UTILITY FLEET

The conversion of one-half of a public utility fleet to a dual fuel operation using natural gas as the primary fuel and gasoline as an alternate is described. Normally, no internal modifications need to be made to the engine of a vehicle making this conversion. The "quick fill" and "slow fill" natural gas refueling systems are described. After the initial conversion of 950 vehicles in 1969, the following problems were identified: drivers complaints of power loss when using natural gas; complaints that mechanics were unable to adjust the systems so that the vehicles would operate equally well on either the gasoline or natural gas mode; and excessive downtime on the fueling station compressors. The solving of these problems is described. Driver acceptance of the natural gas mode has increased steadily as using departments become aware of the impact of rising gasoline prices on equipment operating costs. Vehicle maintenance costs proved to be essentially the same as with straight gasoline operation. One advantage from the emissions reduction standpoint is that an immediate improvement is made in overall air quality in the area in which the vehicles operate, because emissions from older vehicles would be controlled long before the vehicles are replaced by new ones with modern emission control devices. There is an indication of prolonged engine life which may permit an extension of

the useful life of the engine on either of two different fuels provided added flexibility in maintaining service during periods when one or the other type fuel is in short supply.

by William G. Goninan
Southern California Gas Co.
Rept. No. SAE-750074; 1975; 7p 4cfs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 048

USE OF DYNAMIC MODELING AND ANALYSIS TO CURE RIDE QUALITY PROBLEMS

A procedure utilizing advanced dynamic testing and system modeling techniques for solving ride quality problems is discussed. The procedure involves a three-step sequential approach: the problem definition phase, identifying the source of the disturbing input and the resulting vehicle response causing unacceptable ride quality by instrumenting a test vehicle with accelerometers and recording data during a series of operating tests; the structural dynamic properties phase measuring resulting response to the input and processing the data to yield transfer function and/or mode shape measurements by applying controlled excitation to the vehicle with a servo controlled hydraulic exciter; and the mathematical model construction phase simulating dynamic behavior of the vehicle and using it to evaluate proposed design changes. Measurements for the problem definition phase are made of acceleration at suspension, frame, body and interior points. The test vehicle is operated over the type of road and at speeds where the ride quality problem is most severe. Inputs include: driving over a tarstrip, driving over a Belgian block, engine disturbances; and tire inputs. Data are then analyzed to yield information on the type of vehicle response contributing to the problem. This includes frequency spectrum, Speed Spectrum Map, and running deformation shape analysis. The computer model of the vehicle is developed using the system analysis-building block approach or the NASA structural analysis computer program. Examples are given of the application of the procedure to a tank truck bounce problem and a vibration problem in a 12 passenger van. The tank truck was subjected to driving tests; spectrum analysis defined the problem as resonant response to first order tire input; dynamic laboratory measurements identified the source as the overall vehicle first verticle bending mode; an analytical model was developed; and effective design changes were made. Operating tests on the 12 passenger van indicated that transient response of resonant modes to random road inputs was the source of the vehicle vibration; artificial excitation disclosed a number of resonances and design studies, using the model developed, indicated that much improved dynamic response could be obtained by installing a stiffener in the rear of the body which would tie the body side rails and floor pan together.

by Timothy R. Sisson; Garth H. Wiley
Structural Dynamics Res. Corp.
Rept. No. SAE-750078; 1975; 14p 5cfs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

tomotive industry are noted. The three most common automotive structural adhesives are described; epoxy, best where high strength metal-to-metal bonds are desired and bond lines are thin, isocyanate, best for bonding fiber reinforced plastic to itself and to metal and glass to metal, and vinyl plastisol, used where bond thicknesses are large and high strength not required. Adhesive testing in the following areas is discussed: handling; application; strength; production compatibility; quality control; and quality assurance. As examples of applications of structural bonding, metal-to-metal bonding on a truck pickup box, fiberglass bonding of the pick-up box cover, and the development of hood hem flange bonding are discussed. Ultimately, as the automobile body evolves in design and becomes a very efficient load-carrying device, it is expected that adhesive bonding will be as essential to that design as it is in aircraft design today.

by R. H. Beck Jr.; D. A. Yurek
Ford Motor Co.; 3-M Co.
Rept. No. SAE-750077; 1975; 16p 8refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 050

CATERPILLAR'S NEW SLEEVE METERING FUEL INJECTION SYSTEMS

A fuel injection system made up of a family of lightweight, high speed injection pumps is described. With certain design objectives in mind, this sleeve metering fuel system concept was developed and the production of 4, 6, and 8 cylinder pumps was the result. The essentials of the sleeve metering fuel system, a plunger, sleeve, control rod, and barrel assembly, are diagrammed. The injection sequence is explained. The two governor attachments commonly used with the system, the fuel shutoff solenoid and fuel ratio control, are described. Laboratory and field reliability/durability evaluations included the following procedures: laboratory engine tests run at steady state, maximum ratings and cyclic for 1000-3000 hours; a bench test consisting of overspeed tests, high line pressure endurance tests, and running with corrosive fuel water mixtures; and field tests of approximately 300 fuel systems for a total of over 700,000 hours. Endurance testing continued through preproduction to evaluate improvements made. The field tests identified several areas needing improvement; a major one being the need for corrosion protection. The computer controlled test stand, which checks pump and governor performance at the end of the assembly line, is described. The test stand verifies governor control lever motion and torque, governor low idle detent force, fuel injection shutoff at over speed, correct position of sleeve shaft and governor control shaft at rated speed and load, correct sleeve position at high idle, operation of air fuel ratio control, and operation of shutoff solenoid. It also measures injection timing of each pump in the system, fuel pressure in the pump housing and governor housing at rated speed, fuel delivery from each pump unit at rated speed and load, total fuel delivery of the

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Availability: SAE

HS-017 051

ACCIDENT ANALYSIS IN GREAT BRITAIN

Some of the different techniques of accident investigation employed in Great Britain are outlined and their uses and applications are illustrated. National studies utilize statistical computer analyses of data obtained from police accident reports. The main uses of the national data are: providing a means of assessing the need for and effect of national legislation; providing an overall picture of the accident situation by which the areas where more effort should be directed to improve highway safety can be determined; facilitating the examination of trends and making forecasts which will assist in future planning; and providing a basis for comparison in regional and local studies. Regional studies combine statistical analyses with on-site observation of road features, traffic, vehicle maneuvers, and road user movements with the object of identifying common factors and situations, and accident "blackspots." Local studies enable in-depth investigation of vehicle design, injuries incurred, and road user behavior to be made. The results of various detailed studies are presented. Accidents were studied in six towns with populations ranging from 75,000 to 215,000. In three years 12,000 injury accidents were covered. Locations of accidents were related to types of road and land use. It was found that residential traffic accidents made up between one-quarter and one-third of the total in each town. The need was demonstrated for further study into child pedestrian accidents, the problem of intersections, and accidents involving two-wheeled vehicles. The five-man accident team of the Transport and Road Research Laboratory is described. It conducts on-the-spot investigations of accidents in an area of 240 square km near the laboratory and is on call 24 hours a day. Notes and photographs are taken, a scale plan of each accident is drawn, and drivers and witnesses are interviewed. Follow up surveys are also made of the drivers, the vehicle, and accident circumstances, so that contributory factors can be assessed. The main categories of 1164 accidents involving 2049 drivers, 2126 vehicles, and 1069 casualties are broken down. It was found that road factors contributed to 316 accidents, "blackspots" to 183, vehicle design and maintenance to 238, driver action to 948 and pedestrian actions to 71. From such information remedial measures can be identified and instituted.

by Barbara E. Sabey
Department of the Environment, Transport and Rd. Res. Lab.,
Crowthorne, Berks., England
Rept. No. SM-7; 1973; 19p 26refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

University Coll. London, Traffic Studies Group, England
Rept. No. PS-2 ; 1973 ; 19p 4refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

HS-017 058

A SIMPLIFIED APPROACH TO FLOW NETWORK ANALYSIS: APPLICATION TO ENGINE LUBRICATION SYSTEMS

The nature of general flow network problems is discussed, and nonlinear programming techniques are suggested as an especially expedient method of solution. In particular, the computer coding for Rosenbrock's algorithm is given, along with step-by-step instructions for its use in analyzing arbitrary flow networks. Application of the solution technique to the analysis of an engine lubrication system is also presented. Employing the coding for Rosenbrock's algorithm requires these steps: sketch the flow network and serially number all the nodes; list as input data all the parameters associated with the flow path (pipe diameters, node elevations, loss coefficients); write down the component equation for each flow path and impose the condition of flow continuity where necessary; form an objective function for a complex network with "n" number of pressures and flows; guess an initial value for each of the unknowns; code the input data and the equations, and combine this with the code for Rosenbrock's algorithm; and run the program. Where experimental checks are possible, in the measurement of pressure and flow rate at different stations throughout the network, it has been shown that, using this method, the measured and calculated results agree to within 15%. Having established some level of confidence in the analysis, the designer may then proceed to study the relative effects of varying different system parameters. By this means the lubrication system can be tuned to achieve the desired performance without costly cut-and-try procedures. The application of this technique to the analysis of an engine lubrication network has suggested that the procedures are directly useful for computer-aided design in automotive engineering.

by Kenneth H. Huebner
General Motors Corp.
Rept. No. SAE-750080 ; 1975 ; 12p 11refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 059

THE COMPARATIVE MERITS OF PARTICULAR MOTIVATING APPEALS

A study was made examining the influence of horror on the persuasiveness of traffic safety communications and comparing several types of persuasive appeal for their effectiveness. The study of horror appeals was made in the following parts: a qualitative study of reactions to potentially horrifying

included: a single damaged vehicle; two vehicles involved in a collision; an accident situation where a person can be seen to be injured; a situation where a person appears to be dead; and the interior damage to a vehicle following an accident. Three degrees of severity were portrayed for each of the situations. From the subjects' responses, rankings were made of the photographs in terms of how horrifying they were and how likely they were to affect behavior. These two rankings were very highly correlated. Leaving the consequences of an accident to the subject's imagination did not horrify him as much as actually showing the results. Leaflets with mild, moderate and strong fear themes emphasizing seat belt usage were placed on the windshields of cars at service areas on British highways. The leaflets had a statistically significant effect on seat belt usage with no significant difference in effect between the individual leaflets. Two TV campaigns on seat belt usage were compared. Both were very similar except in appeal, one using a family responsibility appeal, the other using a moderately horrific appeal. The two campaigns had similar effects, both more than doubling seat belt usage. The non-horror campaign had a slightly higher peak effect, but the horror campaign appeared to have a more lasting effect. A leaflet experiment similar to the one above was made utilizing seven different appeals for seat belt usage. A factual appeal was found equally as effective as other appeals.

by A. M. Mackie; S. Valentine
Department of the Environment, Transport and Rd. Res. Lab.,
Crowthorne, Berks., England
Rept. No. WP-4 ; 1973 ; 7p 15refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

HS-017 060

PERCEPTION OF A TRAFFIC SIGN AND DRIVING SPEED

Research is presented investigating the relationship between perception of traffic signs and driver behavior (driving speed in particular). A sign "speed limit 30 km/h" was put on a suburban road at a site meeting requirements for proper measurement of the vehicle speed. Speed was measured by a hidden radar before the sign was installed (when the road had no limit) and after the sign was installed. Four hundred and twenty one drivers were stopped after they had passed through the test stretch of the road and asked if they had perceived the sign and what the sign had said. A driver was considered to have perceived the sign, only if the second question was answered correctly. The sign was perceived by 225 drivers (53.4%). Analysis of speed in the speed limit zone before and after the sign showed that average slowing down for the drivers who perceived the sign was 3.0 km/h (from 53.0 to 50.0 km/h). For drivers not perceiving the sign there was no significant change in speed. The difference in the driving speeds of those who did and did not perceive the signs was 7.1 km/h in the zone before the sign (53.0 km/h for those who did perceive the sign and 60.1 for those who did not). It was found that 69% of those driving alone in their vehicles perceived the sign

HS-017 061

PERIPHERAL VISUAL PERFORMANCE IN A SIMULATED DRIVING TASK. SOME QUANTITATIVE ASPECTS

A study was made identifying important variables known to affect peripheral visual performance and attempting a unified approach at developing prediction equations which specify the functional relationships between performance and system characteristics or the independent variables of the experiment. The independent variables are listed and defined as follows: stimulus (circular test object) size, 60, 39, and 18 inches; stimulus colors, red, green and white; stimulus/background contrasts of 89, 59, and 29 ft. L; azimuthal locations of 26° in the upper and lower visual fields and on the line of sight; angular eccentricities of the stimulus of 90°, 64°, and 38°; a continuous central task of driving a simulated vehicle at three different simulated speeds, 60, 40, and 20 mph while tracking a single lane road; and white noise at three different continuous levels, 52, 76, and 100 dBA. The visual simulator had an enclosing parabolic screen giving a total binocular angle of 260°. Twenty right-handed male students between the ages of 20 and 25 who had been driving for at least three years served as subjects. They were examined for lateral and vertical phorias, color vision, and central and peripheral acuity. All had 20/20 vision (uncorrected). They were paid for their time. The subject was told not to move his head during the test and to respond to the appearance of a light in either his left or right visual field by pressing the corresponding switch on the steering wheel. The testing procedure was divided into two main parts: a central driving task with superimposed peripheral stimuli and only peripheral stimuli with no central task. Each part was divided into two blocks of 31 experimental points on each side of the visual field. The continuous noise came through a set of headphones over the subject's ears. Stimuli were random with no simultaneous appearance in both left and right fields. Each block lasted five minutes, with 10 discrete driving stretches and a 2 second rest period after each stretch. Data on intentional response time and tracking performance were recorded on an FM instrumentation tape recorder. Indications are that significant interactions are expected between noise intensity and stimulus locations, stimulus color and performance index.

by D.S. Kochhar; T.M. Fraser
University of Waterloo, Faculty of Engineering, Ont., Canada
Grant NRCC-079-6275-22
1973; 11p 21refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

A study is reported in which "controlled" pedestrians were used to influence real driver-vehicle behavior at pedestrian crossings. Three male students in their early twenties were trained to act as pedestrians. Vehicle speeds, as they approached the experimental site and just prior to the pedestrian's crossing path, were measured. The variables in the experiment were the following: type of crossing (marked or unmarked crosswalk); distance of pedestrian from vehicle (far, close); pedestrian orientation (looking, not looking); and the number of pedestrians (single, group of three). Two urban sites were selected. One was a relatively fast, two-way street with a high traffic volume (Dan site); the other was a slower, one-way street with a lower traffic volume. The crossing locations were situated midblock and the marked crossing was about 100m from the unmarked crossing at each site. Two pedestrian-vehicle gaps were selected for each site; they were 50m and 35m for the Dan site, and 35m and 25m for the Hill site. These distances (once the pedestrian had stepped from the curb) created a crossing conflict but did not put the driver under undue stress. Target vehicles were determined by a team of observers and the pedestrians were alerted to begin the crossing procedure. Vehicle speed was measured at a point 20m ahead of the distance gap for the particular trial and 20m ahead of the crossing. The driver's response, his or her age-group and sex, and the vehicle license plate number were recorded. Of the three trained pedestrians, two took turns acting as single pedestrians, changing every ten trials. Thirty vehicles were observed in each experimental condition for a total of 480 observations per site. An additional 120 speed observations were made at each site without any pedestrians present, under identical experimental conditions. The results indicated that in the driver-pedestrian interaction which took place as the latter began to cross the road, driver initiated behavior was dominant. Vehicle approach speed determined most of the speed reduction made after the pedestrian appeared. Drivers did slow down more for pedestrians at marked crosswalks than for those at unmarked ones. Pedestrians entering the road at short distances from the oncoming vehicle put the driver in a strong conflict situation where he was less likely to give way to the pedestrian. Drivers were found more likely to give way to a group of pedestrians than to an individual. Pedestrian orientation played a small role in influencing driver behavior. Drivers did not appear to interpret the "looking" orientation of the pedestrian as a communication of an intent to cross, but as evidence that the pedestrian was aware of the vehicle, thus increasing the driver's readiness to usurp the right of way. It was also found that stopping or slowing down to the safer approach speeds (less than 40 km/hr) took place when drivers had a time gap of 3 seconds or more.

by Allan Katz; David Zaidel; Alit Algrishi
Technion Road Safety Centre, Haifa, Israel
Rept. No. SM-10-d; 1973; 72p 20refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

slash. It was divided into two experiments. In the first experiment, 34 (17 male and 17 female) paid volunteer university students, with a mean age of 19.5 years, were presented 60 slides of traffic signs, each for 1/25 of a second. The slides were of 15 different prohibitive symbols and each one was shown under the following conditions: red circle; red circle with a partial slash; red circle with a slash on top of the symbol; and a red circle with a slash under the symbol. All stimuli were presented by a projection tachistoscope and the background on the screen was visual noise consisting of colored wavy lines. Subjects sat 9 feet from the screen and the projector was 6 feet behind them. Stimuli were presented one at a time in a random order and the subject was required to match the stimulus with drawings of 16 symbols on a board in front of him. Performance was found to be best with no slash and worst with the symbol on top of the slash. There was no sex difference. Evidence strongly suggested that the presence of a slash significantly reduced the glance legibility of a symbol. In the second experiment, 13 male and 13 female volunteers with a mean age of 21.2 years were used as subjects. The procedure involved was essentially the same as in the first experiment, with the following exceptions: subjects sat 33 feet from the screen; the slide formed a stimulus 3 inches in diameter; the background visual noise was a dark gray street scene; exposure duration was 1/10 second; and the stimulus was slightly out of focus, making legibility poorer. The results were similar to those of the first experiment except for the motorcycle and bicycle symbols which had the fewest number of omissions in the first experiment but the highest number in the second. This suggests that the more complex symbols are degraded at the greater distance and when not in perfect focus. Significant correlation between legibility scores for the two symbols was found only for the no slash condition. At a greater distance, the slash appears to have a differential interfering effect upon different symbols.

by R. E. Dewar
University of Calgary, Psychology Dept., Alta., Canada
Rept. No. SM-10 : 1973 ; 9p 8refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

HS-017 064

ANALYSIS OF ACCIDENTOGENIC FACTORS IN RECIDIVISTS OF TRAFFIC ACCIDENTS

A study was conducted to present a clear review of the problem of accident recidivism among Yugoslavia's drivers. Analyses were made of the following: data on traffic violations and accidents relative to driving experiences; causes of these traffic violations and accidents; data on driving experience itself; and information on the level of health and hygienic habits of the drivers. Data were obtained by direct interviews with the drivers and on the basis of questionnaires. Seventy seven driver questionnaires were used for final processing. All of the drivers had been responsible for violations and accidents. Of the 77 drivers, 35 of them (45%) had had three accidents for which they were responsible. Sixty

tively decreased, to increase again with the group with over 21 years' experience. Professional drivers comprised 39.9% of those interviewed. Fast driving was the dominant violation found (31.2%). Drunk driving was also important (13.6%). Of those drivers found guilty of traffic violations, 24.7% were also found guilty of other violations of the law. Side crashes were found to be the dominant type of traffic accident. Out of the 176 accidents caused by the recidivists, there were 127 injuries. There were 22 fatalities (17.4%), 34 cases of serious injury (26.7%), and 71 cases of light injury (55.9%). At the time of the accident, 27.3% of the drivers were found to be in a health condition unsuitable for driving. Chronic diseases of the digestive system were dominant among these conditions. Also, 27.3% of the drivers were driving while tired, 28.6% while sleepy, 22.1% while under the influence of alcohol. 81.8% revealed that they smoke while driving, and 31.2% had accidents while they were hungry.

by Pavle Todorovic
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Rept. No. SM-9 : 1973 ; 8p 3refs
Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973.
Availability: Reference copy only

HS-017 065

ACCIDENT AND VIOLATION RATES AMONG CANNABIS USERS BEFORE AND AFTER THEIR CONVICTION FOR CANNABIS OFFENCES

Data is reported on accident and violation rates for a sample of persons convicted for marihuana possession and trafficking, and on how variations in these rates relate to conviction. From official records a group of 245 male drivers were chosen. All held a valid drivers' license at least one year before the date of conviction for a marihuana offense and at least one year after conviction or release from custody if sentenced to jail. All subjects were 17 to 23 years of age. The collision rates for this group were compared with the rates for all experienced male drivers (more than a year's driving experience) and the rates for all young (16 to 24 years of age) experienced male drivers. The rates were 70 per 1,000 drivers per 6 months for the young experienced drivers and 42 per 1,000 per 6 months for all experienced drivers. The marihuana group had collision rates about twice as high (123 per 1,000) as the young experienced male driver during the 6 to 12 months before conviction. At 6 to 0 months before conviction the rate fell to 45 per 1,000 drivers per 6 months. By 6 months after conviction the rate was elevated to 110 per 1,000 significantly higher than for young experienced drivers. At 6 to 12 months after the rate fell to 73 per 1,000, very similar to that of young experienced drivers. At 6 to 12 months before marihuana conviction the marihuana group had more than twice as many driving convictions as the young experienced drivers (570 compared to 250 per 1,000). There was a steep decline until the lowest rate was reached 0 to 6 months after marihuana conviction where it stabilized at a point 1 1/2 times the rate for young experienced

HS-017 066

OVERTAKING ACCIDENTS--A STATISTICAL ANALYSIS

A statistical survey was carried out in Britain, France, Switzerland, the Netherlands, and Germany in which 4603 overtaking accidents were evaluated. Data collection was based on a data sheet suitable for processing by computer. A maximum of 178 features for each accident were processed. For each feature, a minimum of two and a maximum of 924 entries were made. In this way, the relatively small sample of accidents gave rise to a great mass of alternatively processed and coded data which could be made available as a data bank. Part 1 of the data sheet contained all the data relevant to the accident situation, including: time of the accident; weather conditions; specific circumstances of the accident site; type and alignment of the road; condition of road surface; width of road; number of lanes; pedestrian areas; number of vehicles and persons involved; numbers injured or killed; and the monetary value of the damage. Each feature or entry in Part 1 could occur only once. Part 2 of the survey, on the other hand, contained the features of the individual vehicles, drivers and other persons involved in the accident. Special data sheets had to be prepared for drivers and vehicles or for persons within or outside the vehicles involved in the accident. In this way the part played by each of the persons involved could be determined. The categories of faulty behavior which had a more or less frequent bearing on the 4603 accidents were identified by offering four features with a total of 41 possible entries and allowing the assessors to add a free description of the event. These categories were divided into accident-causing behavior patterns for the following actions: preparation for overtaking; overtaking; re-joining the traffic flow; overtaken vehicle response; oncoming vehicle response; and other accident-causing circumstances not attributable to the behavior of overtaking, overtaken and oncoming vehicles. It is concluded that this pilot survey offers a statistical example of the type of research without which it will be impossible to achieve a significant reduction in the still excessive number of traffic accidents through legislation, traffic supervision, road education, or traffic safety publicity.

by H. Lewrenz; W. Pittrich
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Überwachungsverein Norddeutschland, Hamburg, West
Germany; Psychiatrische und Neurologische Klinik der
Universität Frankfurt, West Germany

Rept. No. PS-2-C, 1973, 22p

Presented at the 1st International Driver Behavior Res.
Conference, Zurich, Oct 1973. Tables referred to in the text
are included in the original German-language version of this
paper.

Availability: Reference copy only

and non-catalyst cars. All reported automotive test data were obtained using a water-brake chassis dynamometer. The sample collection methods currently in use for sulfate consist of a variety of air dilution-filtration techniques coupled with analytical methods suitable for the sample size, raw exhaust controlled condensation techniques and bubbler methods. All methods appear to give similar sulfate emission results, comparable with those obtained by controlled condensation procedures. Methods for sulfur dioxide measurement in vehicle exhausts need further attention. Results now available from a wide variety of non-catalyst cars in both cyclic and steady state operation show conversions of fuel sulfur of 1% or less and an overall sulfate emission rate of 0.001 g/km or less. Pelletized catalysts in California and 49-state configurations have been found to have different characteristic emission rates in cruise modes, 0.017 and 0.041 g/km respectively. Monolithic catalysts had emission rates similar to those of the pelletized catalysts in both urban driving and cruise modes. An overall value for a 49-state cruise mode, sulfate emission is about 0.2 g/km. It is expected that the highest sulfate emission will be with California expressway driving, where emission rates of 2-3 times the national average can be anticipated. Although additional investigation is needed, it is suggested that diesel and possibly other middle-distillate fueled engines may have sulfate emission rates comparable with catalyst-equipped vehicles.

by Ronald L. Bradow; John B. Moran
Environmental Protection Agency
Rept. No. SAE-750090; 1975; 12p 23refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 068

TACKLING THE ROAD TOLL

The extent of Australia's traffic death toll and the problems inherent in attempts to reduce it are discussed. Close contact between experts in various fields that relate to traffic safety is recommended. Government efforts in the areas of design standards, publicity, and uniformity in traffic laws, accident reporting, and driver licensing are discussed. The need for a multi-disciplinary approach to traffic safety with co-operation between professions and institutions and uniform data collection is stressed. The following research projects sponsored by the Australian Department of Transport are reported: a review of vehicle design; a review of truck and bus safety; a study of the driver's forward field of view; improvement of seat belt design; a survey of vehicle inspection schemes; a preparation of safety guidelines for town planners; the development of a method for the evaluation of priority roads; a study of local street traffic control; a survey of employer-sponsored road safety schemes; an evaluation of the effectiveness of television publicity in promoting correct seat-belt adjustment; an investigation of the nature of accident-related driver behavior; a study of the United States traffic law system; a survey of sentencing practices and attitudes; studies of the effectiveness of sanctions and various penalties for convicted drunk drivers;

HS-017 069

THE EFFECTS OF LEGISLATION ON ROAD SAFETY

Traffic safety legislation is discussed in general terms, with emphasis placed on the need for careful studies to determine the effectiveness of legislation. Some examples of legislation discussed are: compulsory standards of safety in motor vehicle design; vehicle inspection requirements; speed limits; and legislation on drunk-driving. Australian legislation on compulsory seat-belt and motorcycle helmet usage is examined. Victoria's safety helmet law was the first of its kind in the world. Before the legislation 56% of Victorian motorcyclists wore the helmets and afterwards the figure rose to 100% almost immediately. Data reveal drops in fatality rates and, to some extent, in injury rates following the introduction of the legislation. Conclusive proof of the safety helmet's effectiveness would have to be provided by a head injury study (with and without helmets) which included an estimation of the motorcyclist's exposure to risk. Legislation in Victoria and New South Wales required that all occupants of motor vehicles wear seat-belts within a maximum period of two years. Road-side counts have shown wearing rates between 50% and 90%, with variations in time of day, trip length, and in the sex and socio-economic status of the driver. The Victorian survey showed that only 1 in 7 drivers were wearing their seat-belts correctly adjusted. Fatalities and injuries were reduced after the legislation. It has been shown that persons involved in casualty accidents are 2 to 3 times more likely to be killed if they do not wear seat-belts and 1 to 2 times more likely to suffer major injuries to head and neck, chest, abdomen and spine.

by J. E. Cowley
Australian Road Res. Board, Vic.
Rept. No. Paper-2 ; 1973 ; 18p 13refs
Presented at the Seminar on Road Safety and the Law,
Sydney, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 070

THE PLACE OF TRAFFIC OFFENCES [OFFENSES] IN THE CRIMINAL JUSTICE SYSTEM

The underlying assumptions concerning the operation of the criminal justice system are considered; and an inquiry into how well these fit the special case of traffic offenses is made. It is suggested that we still have little more than a "blind guess" whether the present system does the good it is hoped to achieve. Brief references are given to some alternative ways of modifying driver behavior which have been the subject of inquiry or experiment. The two central elements to crime are considered to be deliberateness and harmful consequences to others. Yet there are only a small number of cases in which a driver is punished because he actually did harm to others, and,

the ordinary courts, and placing them under special traffic courts, or both. The fact that motorists will generally readily obey the known traffic regulations if traffic police are visibly on patrol is emphasized. A traffic enforcement system is mentioned which was used in England before World War II. It emphasized example and courteous advice rather than prosecution. In British Columbia certain convictions and fines were abolished and a new system of "violation reports" was established. These reports formed part of a driving record for more effective surveillance of offenders by traffic authorities. It is concluded that the whole problem should perhaps be attacked in the licensing process, that all licenses should be regarded as probationary from the start, and right through their tenure.

by E. K. Braybrooke
La Trobe Univ., Vic., Australia
Rept. No. Paper-3 ; 1973 ; 15p 13refs
Presented at the Seminar on Road Safety and the Law,
Sydney, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 071

THE EFFECT OF TRAFFIC PROSECUTIONS ON THE CRIMINAL JUSTICE SYSTEM

The situation of overload in the criminal courts is discussed. Statistics relating to work loads generally and particularly to the input of work from motor traffic law enforcement are presented. In England and Wales, motorists constitute over 48% of all those convicted of any criminal charge in any court. In New South Wales, Australia, it has been shown that 27% of magisterial resources are taken up with traffic summonses. The number of traffic summonses that are defended is reported to be increasing probably due to the "points" system of license suspension. Because of this overload, the level of personal attention that magistrates give to traffic offenders is minimal. More time is given to offenses, such as shoplifting, which seldom, if ever, cause serious damage or loss of life. The following suggestions are made: more careful training of police so that they will admonish, caution and advise when doing so will not jeopardize public safety, and take court action when all the indications are that the offense or the offender constitute an actual or potential threat to the public; parking tickets should become a charge on the registration of the vehicle concerned or upon the license of the offender; traffic violations should be handled by computer, and after a certain period of non-payment of the fine the offender should be sent an appropriate notice threatening prison sentencing if the fine is not paid; remedial treatment to fit the offense should be utilized; offenses and the dangers that they actually present should be better defined; and if there is a saving of time with institution of any of these suggestions, it should be

HS-017 072

THE ROLE OF POLICE DISCRETION IN TRAFFIC LAW ENFORCEMENT

The magnitude of the police manpower drain caused by traffic enforcement is discussed. Consideration is given to the use of fines, on-the-spot infringement notices and warnings, and the nature of the various discretions and value judgements that must necessarily be exercised by police officers in enforcing traffic laws. In New South Wales, in one month alone, 1171 men spent 211,282 man hours on traffic duty. There are 7,000 reported accidents per month and each one takes up an estimated 2 man hours. Of the strictly penal measures used in general law enforcement, fining has proved most effective. No such study has been made of traffic offenders specifically, but police opinion is that on-the-spot fines are most effective. In New South Wales, the fine system is reinforced by the "points system". No system of road-side warnings appears to exist in Australia. It is suggested that this method be tried, but reinforced by official letters of caution from traffic bureaus after checking the offender's previous record. The importance and problems of police discretion are stressed. Serious offenses cannot be neglected by overattention to the trivial and technical.

by R. P. Roulston

University of Sydney, N.S.W., Australia

Rept. No. Paper-5; 1973; 13p

Presented at the Seminar on Road Safety and the Law, Sydney, Australia, 2-3 Aug 1973.

Availability: Australian Dept. of Transport

HS-017 073

EXPERIENCE WITH WEEKEND PRISONS

Periodic detention in New South Wales is outlined in terms of the nature of the program and its effectiveness since inception in March 1972. Reference is made to the history of the legal sanction, the nature of the scheme, the types of offenders, the types of offenses, court utilization and length of sentences imposed. There is an evaluation of the impact of periodic detention in offenders and the community, on the court and correctional systems, and on its value as a form of sentencing for traffic offenders. Inmates are required to report to the Periodic Detention Center from Friday evening until Sunday afternoon each week. Activities of the inmates focus on community service. Organizations serviced include a boys' club, a hospital, church organizations, police stations, the Salvation Army, a football club, and a number of churches. The work done includes general maintenance, renovation and clearing, and conservation. Almost 70% of the persons sentenced to periodic detention are under 30 years of age. Men engaged in professional and administrative positions are over-represented in periodic detention, 17% compared to 3% in the general prison population. Those born outside of Australia constitute 25% of men in periodic detention. Thirty-five percent had a

detention population. The program has had an 85% success rate (failure being defined as any behavior while in the program which results in subsequent court conviction). Of the 26 traffic offenders who have completed a sentence of periodic detention in New South Wales, 4 have failed. None of the other 22 has returned to the prison since his release. Traffic offenders involved have been charged with: driving without a license, negligent driving, reckless driving, and driving under the influence of alcohol. The following recommendations are made: a diagnostic and counseling service, of particular value for traffic offenders with alcohol problems, should be available; an information and referral service providing factual material through films and lectures should be available on programs and services for alcohol-related problems; periodic detention should be extended to include offenders with a previous sentence of up to 6 months; a planned comparative study of different forms of sentencing for traffic offenders should be carried out on a prospective basis.

by M. S. Dewdney

New South Wales Dept. of Corrective Services, Australia

Rept. No. Paper-6; 1973; 30p

Presented at the Seminar on Road Safety and the Law, Sydney, Australia, 2-3 Aug 1973.

Availability: Australian Dept. of Transport

HS-017 074

THE RANGE OF ALTERNATIVES IN SENTENCING

The four main types of sentences available to courts for dealing with traffic offenders (fine, license suspension, probation, and imprisonment) are considered, both in their simple form and with modifications aimed at increasing their effectiveness. It is urged that greater efforts be made to equate the amount of the fines with the offenders' capacity to pay. Many areas of experimentation with the penalty of license suspension are mentioned. Suspension might be coupled with impoundment of the offender's vehicle so that the number of cases of driving while under suspension might be reduced. There might be provisions for the conditional restoration of licenses such as an ignition interlock device being installed into the cars of convicted drunk drivers. Special conditions might be added to a probation order such as abstinence from alcohol, psychiatric or medical treatment, or retraining programs. Some of the bad effects of imprisonment might be minimized by substituting week-end for full-time imprisonment. Much greater efforts are urged to attack the particular problems of each offender while he is in a prison situation. Positive efforts should be made, to fit the penalty to the offender, not necessarily to the offense alone.

by D. Biles

University of Melbourne, Criminology Dept., Australia

Rept. No. Paper-7; 1973; 11p

Presented at the Seminar on Road Safety and the Law, Sydney, Australia, 2-3 Aug 1973.

Availability: Australian Dept. of Transport

HS-017 075

A SURVEY OF THE ATTITUDES OF MAGISTRATES AND JUDGES, WITH RESPECT TO SOME ASPECTS OF SENTENCING MOTOR TRAFFIC OFFENDERS

A 35 item, 4-point multiple choice plus commentary type questionnaire was sent to 290 magistrates and judges throughout Australia. The questions requested the respondent's views on driver licensing, sentencing policy and procedures, alternative sanctions, and systematic experimentation with sentencing first offenders. At the time of the first computer run, 192 replies had been received. The average age for the group of respondents was 47-48 years. Forty-three percent had served on the bench for five years or less, 48% for 6 to 15 years, and fewer than 10% for 15 to 30 years. Almost all (99%) held driver's licenses, 154 driving for 10 years or more, and as a group had been involved in one accident for every 50,000 miles driven. The following results emerged from the questionnaire: the majority considered licenses too easy to obtain (114); 128 believed that the learner driver spends inadequate time in training; 17-18 years was the most favored licensing age; comments suggested more control of licensing and the use of testing situations and, in a few cases, personality and intelligence tests; 164 considered very few traffic offenses as criminal; most (145) of the respondents felt that attention should be given to the question of decriminalization of traffic offenses; 168 considered that in very few cases should an administrative tribunal take over the jurisdiction of traffic offenses; 129 considered themselves unhampered by the amount of penalties in "on the spot" fining; 151 saw their own sentencing policy as moderate; 92 considered license suspension an effective penalty on its own while 92 did not; and 104 stated that they impose the maximum penalty rarely, while 101 indicated that they impose the minimum penalty occasionally. In regard to experimental sanctions the following results emerged: 154 of the respondents indicated that they would impose attendance at a driver improvement school in lieu of the standard penalty, while 155 opposed the idea of traffic safety essay writing even though it has been proven effective in another study; 121 indicated that they were in favor of assignment of first offenders to treatment programs; and 131 indicated their willingness to experiment with any offense. A comprehensive distribution of all the responses is given.

by J. W. Watson
New South Wales Public Service Board, Personnel
Assessment Centre, Australia
Rept. No. Paper-8; 1973; 17p 5refs
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973. On cover: "A survey of
Magistrates' Attitudes".

Availability: Australian Dept. of Transport

HS-017 076

COMPARATIVE LEGISLATION AND LAW ENFORCEMENT IN THE U. S. A.

Endeavors to achieve a uniform traffic law code in the United States (U.S.) are examined. The legislative powers and procedures are examined in the federal (Department of Transportation and National Highway Traffic Safety Administration), and state levels. The role of the National Committee on Uniform Traffic Laws and Ordinances (NCUTLO) is discussed. The nature of the U.S. traffic court system is discussed. Some states were found to emphasize bringing all offenders to court while others did not. For certain offenses,

the defendant must be arrested, for some others, it is mandatory that he appear in court. As an example, the enforcement process in Illinois is examined. In most U.S. states, traffic violations are listed in the Traffic Division of the municipal courts. It was found that the procedure for enforcing penalties incurred by traffic offenders varies markedly from state to state. The real threat is that the offender's license will not be renewed while he has court obligations to meet. Recent legislation is discussed regarding state supervisory powers, title to motor vehicles, abandoned vehicles, fleeing the police, elimination of multiple charges, night courts, and seat belts. The following projected legislation being commended by the NCUTLO is discussed: pre-sentence investigation for alcohol addition; suspension of vehicle registration in some cases of drunk driving; requirement of physicians to report any mental or physical disability affecting the ability of a person to drive safely; deferment from imprisonment in some cases; medical and psychiatric examination before and as part of sentencing; further suspension of drivers license; and the modification of present systems of school bus warning lights. Trends in sentencing regarding driver improvement programs, alcohol addition, and positive re-enforcement are discussed. Some current research is reported. The efforts toward uniformity in traffic law, the attitude toward driver licensing (as a privilege that can be withdrawn), the constructive analysis of records of delinquent drivers, the important status of traffic courts, the acceleration and refinement of automatic data processing, and the idea of decriminalization of traffic offenses are again reviewed as they exist in the U.S.

by M. F. Farquhar
Bench of Stipendiary Magistrates, N.S.W., Australia
Rept. No. Paper-9; 1973; 19p
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 077

LAW REFORM FOR ROAD SAFETY

The role of the law and the possible directions of law reform, in relation to road safety, are considered. The excessive emphasis that has been put on the law, especially criminal law, in attempts to deal with road safety is pointed out. Criminal sanctions have failed to achieve the desired results and may be counter-productive. The regulation of human behavior, through penal laws and regulations, as attempted in relation to road safety and industrial safety, is compared and discussed. It is concluded that the comparison is valid in that there are far too many differing regulations in both cases. Further examination of the use of criminal sanctions with a view to considering a more selective procedure is recommended. The role of the civil law and of insurance practices which entangle the law are considered. It is concluded that it would be much cheaper to operate a system of insurance in which each owner was free to decide whether to insure his car or not and claims against third parties were not permitted.

by P. S. Atiyah
Australian National Univ., A. C. T., Australia
Rept. No. Paper-10; 1973; 12p 7refs
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 078

PROGRESS TOWARDS SCIENTIFIC SENTENCING

Current sentencing systems in Australia are examined. The lack of a scientific approach and the need for specialized training of sentences are pointed out. Consideration is given to the responsibilities of magistrates and to discretionary and arbitrary penalties. Of the 110,500 persons convicted in South Australian Magistrates Courts in the year ending June 30, 1971, 62% were convicted for traffic offenses. Despite a general increase in crime, courts appear to be devoting a higher proportion of their time to the automobile. The traffic offender and the punishment he receives becomes a most important social problem because the traffic policeman is often the average citizen's only contact with the law. When penalties for offenses are discretionary, either determined by the policeman or by the magistrate, a situation of indignation and resentment for the law can be created if penalties for the same offense vary from person to person, (there is always this possibility). In conclusion, the following suggestions are made: that governments recognize the importance of Stipendiary Magistrates (the judicial officers in closest contact with the community), and that they be carefully selected and trained; that separate courts' systems and facilities be updated and simplified; that every effort be made to shorten the period between apprehensions and court hearings; that magistrates should have more opportunity to exchange views with other magistrates and persons in relevant fields in seminar and discussion situations; that the system of on-the-spot tickets be greatly expanded and police trained accordingly; that more regulatory offenses should be punishable by fixed monetary penalties; that, where imprisonment is required, Parliament fix both minimum and maximum terms; that alternatives to imprisonment, such as default of license for non-payment of fines, be examined and utilized; that the tolerance now granted to the consistent offender be re-examined; that the role of the jury in serious cases of motor vehicle violations be reviewed; and that all courts have authority and simple means for compulsory preliminary referral of drunken drivers for general investigation.

by J. H. Muirhead
Australian Inst. of Criminology, A. C. T., Australia
Rept. No. Paper-11; 1973; 14p
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 079

THE ROLE OF CRIME STATISTICS

The relations between crime statistics, social values and social policy are discussed in terms of drunken drivers. The role of crime statistics in the formulation of social policy is examined. Criminal and judicial statistics help specify some of the dimensions of the problem, such as the risk characteristics of the various community groups, and the interactions between penalties and offenders. In addition to the blood alcohol content (BAC) of the driver, his occupation, previous traffic record, and the penalty imposed by the court, statistical reports now include the offender's age, sex, area of residence, whether he was legally represented, the plea entered, and the details of any previous non-motoring offenses. Over a two-year period the number of breathalyzer offenders in New South Wales continued to increase at the rate of 25-30% per year. Men accounted for 98.2% of those convicted. Young

men between the ages of 18 and 24 account for 31.7% of these breathalyzer offenses. It was found, however, that the higher the age bracket, the greater the proportion of medium and high BAC reading. Unskilled workers were found to be greatly over-represented in breathalyzer offenses. One in five of those convicted had a history of previous drunk driving offenses. Members of this group were more likely to have a medium or heavy BAC reading. A fine was part of the penalty in 87.5% of the cases, and fine and suspension occurred in 83.1% of the cases. The average fine in 1972 was \$146.00. Fines and periods of license suspension were shown to vary according to the offender's BAC level, and both were heavier in cases involving multiple offenders. Only 1.9% of the offenders in general, 0.4% of the first offenders, and 7.7% of the multiple offenders were given prison sentences. Almost all of those convicted pleaded guilty. It was possible to cross-tabulate data concerning legal representation with the penalties imposed by the courts but results have not yet been presented. Further research is recommended to keep under review the competing values within the legal institution and to help examine the relationship between the penalties imposed upon different kinds of individuals and their subsequent behavior. Judicial statistics can also supply each court with an analysis of the range of penalties imposed for different types of offenses.

by T. Vinson
New South Wales Dept. of the Attorney-General and of Justice, Bureau of Crime Statistics and Res., Australia
Rept. No. Paper-12; 1973; 23p 1ref
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 080

SOCIOLOGY OF THE ACCIDENT-INVOLVED

Findings are presented regarding traffic and criminal offenses of samples of drivers involved in serious accidents in and around Brisbane, Australia. An original survey, consisting of a full interview and examination of previous traffic accident and criminal records, was made of 216 drivers involved in accidents within the city limits of Brisbane to which an ambulance was called. A follow up study was made 7 years later of 75% of the drivers involved in the original survey. Another study was made, similar to the original survey, of 100 drivers involved in rural accidents within 100 miles of Brisbane. Two samples of drivers, a random one of 330 drivers interviewed by home visits within Brisbane and a quasi-random one of 556 license holders taken from an alphabetical register, were established as controls at the time of the original survey. The original sample was compared with the control samples. Drivers were classified as to type of accident (single-vehicle, multi-vehicle, or pedestrian) and type of behavior preceding accident (reckless, negligent, not at fault, or unable to be assessed). Records were studied. The various psychological and sociological characteristics of the drivers studied were classified as follows: psychological tests; other personality factors; class and cultural aspects; family background; interests; driving experience and habits; factors related to age; and proximate factors (just prior to the accident). The age and sex distribution, sociological profiles, and accident and criminal records of the rural accident-involved were quite similar to those found in the metropolitan group. At the time of follow up sample, drivers appeared to have maintained at least some of the characteristics which differentiated them from the original control sample. There was great fluidity of employment, but little improvement in occupational status or income.

to driving; traffic accidents and violations; responsibility for accidents; and criminal records. It is concluded that the notion that the severity of the survey accident constituted a deterrent should be doubted in view of the fact that 25 drivers acquired criminal records after the accident, 15 added to their previous records, 105 were involved in further reportable traffic accidents, and 140 had traffic violations recorded against them. The study of rural accidents revealed that 20% of the drivers involved had criminal records. At the time of the original survey it was found that those considered reckless in their behavior in the survey accident were significantly more likely to have criminal records than those in the negligent group while those apparently involved by chance had an intermediate effect on criminal records. After 7 years, however, these differences had largely disappeared so that there was no significant discrepancy between the rates of criminal records in the various categories. All were strikingly higher than the rate found in the quasi-random control sample.

by K. G. Jamieson
Royal Brisbane Hosp., Australia
Rept. No. Paper-13; 1973; 23p 3refs
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 081

DIMENSIONS OF THE DRUNK-DRIVING [DRUNK-DRIVING] PROBLEM

Various dimensions of the drunk-driving problem and recommendations for the improvement of countermeasures are presented. Statistics on drinking in Australia, including those concerning consumption (Australia compared with other countries), age and sex of drinkers, alcohol revenues, and death from cirrhosis of the liver, are given. The connection between social drinking and alcoholism is discussed. It is recommended that a survey be conducted in a small city to determine how many drivers drive after drinking. Drivers would be randomly stopped, tested, and dismissed with no threat of prosecution. Better data are needed, also, on the numbers of those drivers also analyzed, charged, and convicted, for specified areas and time periods. Blood tests are recommended for all injured road users and traffic fatalities. The actual values of the blood alcohol concentration distributions found in dead crash victims, in surviving crash participants, and in aberrant drivers breathalyzed by the police, have been found rather similar. Rapid, impartial punishment is recommended for those convicted of drunk-driving. The effects of different sentences need further study. More systematic study of medical and psychological treatment of drinking drivers is recommended. Basic to all measures are efficient, up-to-date, national driver records, so that the rate of recidivism can be accurately determined. Efforts to achieve statistical uniformity in Australia have so far had little success.

by J. S. Robertson
University of Adelaide, Australia
Rept. No. Paper-14; 1973; 22p 10refs
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

A brief review is made of those measures which have been or are now being undertaken and which are now being considered for the future as attempts to control the drunk-driving problem. Measures are grouped into the following categories: controls on alcohol consumption; behavioral controls on driving after drinking; mechanical controls on driving after drinking; and therapeutic and rehabilitative approaches. The few measures in use to control alcohol consumption are of unknown effectiveness. Behavioral controls on driving after drinking are included in most of the measures used throughout the world. Legislative and regulatory measures including the breathalyzer and the Alcohol Safety Action Program in six states in the United States are discussed. The effectiveness of punishment suffers from the fact that few people accept that alcohol is perhaps the most important causal factor in serious automobile crashes. Regarding educational measures, most authorities are leaning towards an approach which calls people to a responsible attitude to drinking and driving, whereby drinking in moderation before driving, although undesirable, is not completely eschewed. Extensive efforts are being made to identify "problem" drinkers and to provide rehabilitative and therapeutic alternatives to sentencing. Most of the programs are still too new to be properly evaluated. Devices designed to make it very difficult for a drunken person to start a car are being developed. They are of two types: those which demand the successful completion of a manipulative task before the ignition circuit can be activated; and those in which the ignition circuit is inactivated by the presence of alcohol in the breath. The field promises good returns only if the various technological problems can be overcome. It is concluded that the importance of measures other than attempts to change human behavior should be stressed, particularly in the search for short-term improvements. Effective modifications to the related parts of the system (seat-belt use, crashworthy cars, a less hostile roadside, street lighting and traffic lights) reduce losses in crashes involving all road users.

by J. M. Henderson
Department of Motor Transport, N.S.W., Australia
Rept. No. Paper-15; 1973; 15p
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Australian Dept. of Transport

HS-017 083

IDENTIFYING THE PROBLEM DRINKER IN A COURT SETTING

An attempt is made to come to terms with the problem of identifying the "problem" drinker. A set of definitions relating to drinking patterns based on quantitative assessments has been worked out in Australia. Excessive drinkers were defined as those whose alcohol consumption exceeded the following amounts: an average daily intake of 100 grams; blood alcohol concentration (BAC) rarely exceeding .06; and the intake on any single occasion rarely exceeding 120 grams of ethanol. A survey of community drinking habits in a suburb of Melbourne showed that 76% of the adult males (age 20 and over) had an average daily intake of 40 grams of alcohol or less. There were no problems associated with drinking in this group. As the average daily intake of alcohol increased so did the proportion of people with problems associated with their drinking. The

drinking driver appears in court in the guise of a traffic offender; the problem is presented as being his driving, not his drinking. A survey of breathalyzed drivers in Melbourne showed that at least one in four had more than one drunk-driving conviction and some had as many as five convictions. A series of interviews were conducted at courts in Melbourne after the drunk-driving cases had been heard. Of the 23 drivers interviewed, 21 were clearly excessive drinkers. The drinking patterns of those with problems differ sufficiently from those of the community at large to be recognizable at an early stage of a drinking career. The courts provide one channel through which intervention can occur. A BAC below the accepted level for excessive drinking does not eliminate the possibility of hazardous drinking patterns. More than the BAC must be taken into account before a driver is excluded from assessment and/or treatment as a "problem" drinker. A brief discussion is made of overseas experience in dealing with "problem" drinking drivers, but it seems that there is more to be learned about methods of dealing with such drivers than about the process of identifying them. It is suggested that the breathalyzer can do for alcoholism what the chest x-ray has done for tuberculosis. It may detect the early signs of drinking problems long before more obvious physical and psychological symptoms appear.

by A. E. Raymond

Australian Road Res. Board, Vic., Australia
 Rept. No. Paper-16; 1973; 16p 9refs
 Presented at the Seminar on Road Safety and the Law,
 Sydney, Australia, 2-3 Aug 1973.
 Availability: Australian Dept. of Transport

HS-017 084

ACCIDENT INVOLVEMENT OF THE YOUNG DRIVER

It is known that young drivers are involved in more accidents per person, and per mile driven, than older age groups. A summary is made of the possible factors involved in and the research conducted into the high accident involvement rate of young drivers. Driving is defined as a skill composed of manipulative and decision making abilities. The importance of driving experience is stressed. The effects of age and sex on accident involvement rate are pointed out. Males aged 18 and 19 have substantially more crashes than men younger or older, according to one study. Another study concluded that females appeared to be a more aberrant group than males in accidents. A study supporting the hypothesis that driving behavior is learned more in a family context than in an institutional one and that a bad family background may result in delinquent traffic behavior is mentioned. The results of one study suggested that tensions surrounding the onset of adulthood spill over into driving behavior. It has been found that 35% of those arrested for drunken driving are less than 25 years old. However, it must be questioned, as in other studies whether this is a representative sample or a case of selective enforcement of traffic laws. The two skills of learning to drink and learning to drive are carried out at the same time, and it has been suggested that the driver licensing age be lowered to displace this coincidence. Study has concluded that such a step would not be justified on the grounds of accident reduction. When the effect of bias due to driver training courses being voluntary is removed, their effectiveness has been shown to be zero. There is room for the development of a more effective course. From another study that expects bad driving behavior from a young driver in as much as he is considered

by the older generation to be a part of a deviant population, it is concluded that reducing hostility towards adolescents might reduce their deviance.

by R. W. Cumming

Monash Univ., Vic., Australia
 Rept. No. Paper-17; 1973; 11p 19refs
 Presented at the Seminar on Road Safety and the Law,
 Sydney, Australia, 2-3 Aug 1973.
 Availability: Australian Dept. of Transport

HS-017 085

CHARACTERISTICS OF THE YOUNG DRIVING OFFENDER

Young adult male drivers, disproportionately involved in severe traffic accidents, are discussed. Some of the sociological factors (family background, employment, criminal records, symbolic importance of automobiles) which contribute to the accidents of this group are discussed. As young drivers comprise about 30% of those convicted for drunk driving in Victoria, the problem of alcohol and driving is discussed. The factors that make current laws somewhat ineffective in dealing with the problem are the following: the small chance of apprehension by an undermanned police force; the lack of severe punishment; the attractiveness of driving fast after drinking as communicated by advertisements; and the deficiencies in public transport that make driving a necessity. The following suggestions are made: data on alcohol-related accidents and the effectiveness of countermeasures must be collected; communities should start objective and constructive alcohol education well before the ages of 18 to 24; the adult community should be educated regarding the methods of measuring alcohol consumption; road blocks and spot checks may be needed; the legal drinking age should be separated from the legal driving age; manufacturers of cars and alcohol should assess the morality of their advertizing; young drunk-drivers should be assessed and treated therapeutically as possible or potential alcoholics; and the world of business, industry, and commerce should provide better examples for the young male to follow.

by J. H. W. Birrell

Victoria Police, Australia
 Rept. No. Paper-18; 1973; 18p
 Presented at the Seminar on Road Safety and the Law,
 Sydney, Australia, 2-3 Aug 1973.
 Availability: Australian Dept. of Transport

HS-017 086

PROBATIONARY LICENCES [LICENSES] AND POINTS DEMERIT SYSTEMS

The characteristics of probationary license schemes and points demerit systems are examined, and the assumptions which underlie their use are considered. They are seen as aspects of an increasing concern with the guidance, correction and rehabilitation of the traffic offender instead of an exclusive reliance on punishment. Both methods of selective enforcement create a need for the establishment and maintenance of individual driver records. The value of probationary licenses appears to be indeterminable. Points demerit systems appear to have some effect towards the reduction of traffic offenses, when operated with some kind of personal contact with the individual driver. Warning letters alone seem to be of some ef-

fect; more intensive treatment of a therapeutic nature appears to be unjustifiable in cost-benefit terms, but the possible value of training schemes aimed at eliminating specific driving faults needs investigating. The actual number of licenses withdrawn under probationary license schemes and points demerit systems is small, so that the effectiveness of these methods does not depend on the readiness to apply them. It is suggested that the essential value of such methods is the information feedback which they provide to the deviant driver, so that he is made aware that his behavior does not conform to the standards of the community.

by C. Cameron
Australian Road Res. Board, Vic., Australia
Rept. No. Paper-19 : 1973 : 15p 8refs
Presented at the Seminar on Road Safety and the Law,
Sydney, Australia, 2-3 Aug 1973.
Availability: Department of Transport, Sydney, Australia

HS-017 088

SIMULATION OF FREEWAY PRIORITY STRATEGIES (FREQ3CP). FINAL REPORT

The development, computerization, and application of an analytical procedure for entry control at freeway ramps are described. Two types of control strategies are developed: control on a passenger basis and control on a vehicle basis. The analytical procedure encompasses two models. The first is a simulation model, FREQ3, which is deterministic and macroscopic, that predicts the freeway traffic performance as a function of freeway design and allowable ramp flows. The second is a decision model, PREFO, which has a linear programming formulation, that selects a priority entry control strategy (a set of allowable ramp metering rates and priority cut off levels) that maximizes an objective function such as maximum passenger-input (vehicle occupancy) or maximum passenger miles of travel, subject to constraints such as no congestion on the freeway and reasonable ramp metering limits. The simulation model was validated under field conditions, and the predicted traffic performance compares very favorably to actual, measured traffic performance. The two models were integrated and computerized, and the composite model was applied to a number of sites to demonstrate its applications and to provide some results for possible implementation. A guide for the user is provided. The composite model was designed to ensure maximum flexibility for the user. It has three modes of operation with the following uses: evaluating freeway design alternatives and the consequences of changes in traffic demand; selecting a vehicle entry control strategy, and evaluating traffic performance, with and without vehicle entry control; and selecting a priority entry control strategy, and evaluating traffic performance, with and without priority control. The operation of the decision model computer program is described and a general flowchart for each subprogram in the decision model is given. Procedures for refining the control strategy and field implementation of priority entry control projects are described. Ramp entries to be used must have two lanes through the metering area. One lane ramps may be modified to two lanes, but the minimum width should be 22 feet. Traffic signals, actuated by induction loop detectors, must be installed at each on ramp. Ramp metering has proved a very successful tool for increasing a freeway's throughput with a minimum of undesirable side effects. Two ramps in Los Angeles, California that are being metered on a priority basis, have had good success. The number of car pool vehicles has doubled, and evidence suggests that many of

these car pools were formed as a result of the priority entry concept.

by Khosrow Ovaici; Adolf D. May; Roger F. Teal; James K. Ray
University of California, Inst. of Transportation and Traffic Engineering Berkeley, Calif. 94720
Contract FH-8083
1975 : 495p 101refs
Rept. for Jun 1973-Mar 1975.
Availability: NTIS

HS-017 089

HUMAN SAGITAL PLANE TORSO BENDING RESPONSE: LUMPED AND DISTRIBUTED PARAMETER MODELS

Mathematical modeling of human spinal bending response in the sagital plane is discussed from both a continuous and lumped parameter point of view. A review of past models is included, and anatomical data are given for these. Parameter identification techniques which have been employed on lumped and distributed parameter models are discussed and the usefulness and applicability of such techniques to the system under construction is shown. All of the factors contributing to whiplash injury point to deformation and motion of the head relative to the torso. For this reason and for reasons of mathematical simplicity, lumped parameter models are used. These range in complexity from simple, single mass models which treat the head as the only mass in the system, to extremely complex models which have as many as 11 individual masses. A representative lumped parameter model which simulates the head/upper torso combination as a rigidly pinned interconnection of 4 masses is examined. Torsional springs and damping are provided at each pin joint to simulate the behavior of muscle and other fibrous tissue during collisions. The equations of motion are derived in terms of generalized coordinates. Geometric and inertial values are readily determined from measurements taken from frozen cadaver sections and from measurements of anthropometric dummy segments. In view of the continuously distributed physical nature of the spinal bending problem, a continuous or distributed parameter model is more attractive than a lumped parameter one. The problem is considered as the development of a differential equation of motion for large geometry, transverse vibrations of a continuous beam with a lumped mass at one end. The lumped mass represents the mass of the human head while the continuous beam models spinal bending. Because of the nature of the physical problem, it is not possible to make direct measurements on the system, the spine, in order to determine values for such parameters as spine effective length and flexural characteristics. A parameter identification technique is required.

by L. Daniel Metz
University of Illinois at Urbana-Champaign, Dept. of General Engineering
Publ: Identification and System Parameter Estimation. IFAC Symposium (3rd), Proceedings. The Hague, 12-15 Jun 1973, p187-93
1973 : 18refs
Presented at the 3rd IFAC Symposium, the Hague/Delft, the Netherlands, 12-15 Jun 1973.
Availability: See publication

HS-017 090

SEE AND BE SEEN DRIVING

The physiological limitations imposed on our abilities to perceive, recognize, decide, react, and evade an accident are discussed. The four leading factors in accidents are considered to be improper lookout, (particularly at intersections), excessive speed, inattention, and improper evasive action. A chart is provided which illustrates the estimated human-machine, time-distance relationships of two autos traveling on a head-on collision course of 55 mph (or at a combined closing speed of 110 mph). An elapsed time of 2.05 seconds is the bare minimum available under perfect conditions, for both men and machines, for either driver to avoid collision. Perceptual lag, the estimated one-tenth of a second for eye-to-brain communication, is considered. Recognition of what the driver sees requires another half second. The decision time, determined by the experience level of the driver, is the next crucial factor. Under ideal conditions it can vary from .15 to .85 seconds but it can take as long as several seconds. Following his decision, the driver then has a minimum of .3 seconds to physically react. This could take several seconds, however, depending on experience. The time needed for the driver's vehicle to mechanically respond to his inputs to the controls and to successfully change the collision course is the final factor. The estimated minimum time for this is one second. It is concluded that the human demands of this type of driving situation may exceed a driver's abilities, that collisions will continue to be a constant threat, and that the only remedy to these problems is to recognize the limitations of driver and vehicle. The following factors can influence a driver's ability to avoid an accident (illustrated with photographs): headlight maintenance; the size of the drivers nose; a panoramic rear-view mirror; an anti-glare rear-view mirror; sunglasses of high optical quality; rest breaks on long trips; windshield wiper maintenance; a reminder of safe speed affixed to the speedometer; and expansive window areas offering minimum obstruction and optimum field of view.

Publ: Driver p19-24 (Jul 1975)
1975 ; 8refs
Availability: See publication

HS-017 091

WORK INJURIES IN TRUCKING. CALIFORNIA

The accident factors in the trucking industry in California are analyzed. The analysis covers work-time lost to injuries or illnesses reported under the California Workers' Compensation Act. Source documents were 2,223 employers' reports of occupational injury or illness received by the Division of Labor Statistics and Research from July to September 1973. More than a thousand of the disabling injuries reported were sustained by employees of companies engaged in long distance or "over the road" trucking service, either as common carriers or under special contracts. Thirty-six percent of the injuries were to employees of local trucking firms. A total of 362 work-connected injuries were sustained by employees of moving and storage companies. A total of 1,401 drivers, 63% of the recorded injuries, were hurt on the job. More than half of the accidents were associated with loading and unloading activities. Eight percent of them occurred while driving, and another 8% while the worker was climbing on or off the vehicle or dock. Three out of ten workers were injured as a result of "strain of overexertion" accidents. "Struck by or striking against" accidents accounted for 25%. A total of 228 accidents

involving moving motor vehicles were reported. Vehicles accounted for almost one out of every four accidents. Strains, sprains, dislocations, and hernias were the most frequent type of injuries, accounting for 1,014 injuries or 46% of the total. Less than 2% of the injured workers were women. An injury and illness survey of the California trucking industry showed an incidence rate of 20.8 (per 100 full-time workers) for 1972 and 20.6 in 1973. Lost workday cases (days away from work or of restricted activity beyond the day of injury or illness) had an incidence rate of 9.5 in 1972 and 10.0 in 1973. The incidence rate for lost workdays was 180.9, far above the all-industry rate of 58.4. In 1973, a total of 159,000 lost workdays were reported (or 18 workdays lost for each workday case). The 230 registered fatalities in the California trucking industry for the period 1969-1973 are reviewed also. Drivers accounted for 200, or 86%, of the fatalities. Accidents involving highway motor vehicles accounted for 188 deaths. Forty-two, or 18%, of the fatalities involved causes other than highway vehicles. These are broken down by accident type also and a few of the individual accidents are described. Tables are provided which will give a fuller account of trucking accidents by occupation, activity, detailed accident type, detailed cause involved, accident type and agency involved, nature of injury, and nature of injury and part of body affected.

by Lilia Vargas; Karen Jones; Jean Powers
Dept. of Industrial Relations, California Div. of Labor
Statistics and Res., San Francisco, Calif.
1975 ; 23p
Availability: Corporate author

HS-017 092

A PROGRAMME [PROGRAM] TO EVALUATE PRIORITY ROADS [IN AUSTRALIA]

An attempt is made to examine the nature and purpose of priority roads and to develop a methodology for their evaluation on a uniform and consistent basis. A literature review is presented of work done to determine the consequences of priority rules at intersections in terms of their effect on accidents, travel times, delays, capacities, vehicle running costs, and pedestrian/vehicle interaction. An evaluation methodology for the priority road system is explained. The development of a procedure for evaluating the change in accident rate and severity would proceed in the following manner: establish classification system and data base; collect accident data; cost accidents by accident classification; collate before and after accident data; and determine non-quantifiable impacts of road accidents. Measurements should be made of drivers' observance of the new road rules and the observance should then be tested for correlation with the corresponding accident statistics. A method for evaluation of network travel times and capacities is presented. It involves the formulation of study procedures for all forms of private transport, commercial and non-commercial. These procedures include the following: the simplistic approach to travel time and capacity (direct measurement prior to and after implementation of the priority road scheme); monitoring those changes in travel time and capacities occurring throughout the study network, including values of travel time in relation to route capacity; making travel time surveys during both peak and off-peak conditions; measuring the directional travel times separately from capacity; repeating measurements on different sections of the route to account for degrees of fluctuation in recorded travel times due to various interruptions in traffic flow; and measuring the travel times on a "straight through" basis at intersections, as the vast amount

of data collection necessary makes it impossible to incorporate all possible turns. The impacts of priority roads on public transport is discussed. Measurements of effectiveness could be taken by observers travelling on public transport vehicles, during peak periods in both directions. To assess the total impact, the average patronage for each run should be recorded. Various propositions for evaluating the actual monetary value of the time saved by priority roads are discussed. It is suggested that an evaluation of vehicle running costs include only vehicle fuel consumption on a section by section basis. To yield the rate of fuel consumption of commercial vehicles, it would be assumed that it is 2.5 times the rate of a typical passenger car. For evaluating pedestrian/vehicle interaction, acceptable levels of interaction pedestrian delay are examined for residential roads and high pedestrian generation sections of major arteries. The evaluation should be performed by comparing delay characteristics for before and after situations. The proportion of pedestrians delayed in attempting to cross the road would be the characteristic to be collated. The method of collation, using an "Achievement of Standard Index" is described. It is suggested that it would be useful to perform an economic analysis for those impacts of priority roads that can be expressed in monetary terms including changes in accident frequencies and severities, changes in travel times, and changes in vehicle running costs.

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Melbourne, Vic., Australia 3004
1974 ; 177p 24refs
Prepared for the Australian Dept. of Transport.
Availability: Corporate author

HS-017 093

REVIEW OF TRUCK AND BUS DESIGN IN RELATION TO ROAD SAFETY [IN AUSTRALIA]

The special problems involved in truck accidents are surveyed and recommendations are made for design changes to help reduce the accidents involving trucks and the consequences of such accidents. Buses, especially school buses, are considered separately and again, important design changes are recommended. Truck and bus accident statistics for Australia (Victoria, New South Wales, and Queensland), England and the United States are reported. Truck body design changes emphasizing injury reduction are examined in terms of structural integrity, secondary collision factors, and under-run barriers. Recommendations to improve integrity of truck cabs include: safety door latches; forward tilting collapsible steering columns; more yielding, two spoke steering wheels; driver seat belts; head restraints, and impact protection; and crash safety latches for tilt cabs. Factors of truck handling and stability, such as braking, parking brakes, brake hoses, aerodynamics, vehicle dynamics, and tires are discussed. The following conclusions from a review of present research are presented: more information based on Australian data is required; brakes are required on commercial vehicles which provide safe decelerations at the same level as cars under all conditions of loading; the proper securing of loads should be treated as an operational problem; parking brake operation should be simplified and design should allow for any effects due to brake cooling; there should be no increase in truck width or height without proper study of aerodynamic effects; design criteria for best handling need to be established; very heavy, articulated trucks need springs of variable stiffness to counter roll-resonance; the special characteristics required for commercial tires should be determined; consideration should be given,

after study, to the banning of retreaded tires for commercial vehicles; tread depth standards for truck tires are needed; and safety rims should be used on all truck wheels. Changes in the design of truck bodies are considered in terms of anthropometry and driver capabilities, vision, road spray, and driver fatigue. Special consideration is given to school buses in terms of their collision performance, interior characteristics, restraints, seat design, occupant kinematics in the event of an accident, evacuation facilities, and the necessary regulatory standards. In addition, brief consideration is given to the problems of passenger buses, to the need for emergency exits, and to the fire risk of buses. The following conclusions are presented: heavy vehicles require a collision resistant structure at passenger bumper height; there is a need for collapsible steering columns on buses; buses should have seat back heights of 28 inches, as well as arm rests and generally crash-worthy seats; seat belts are needed for the driver and all passengers; the passenger needs either a three-point seat belt or a crash structure in front of his seat; seats should be designed to withstand a 30g deceleration and 20g acceleration; there should be no standing passengers; four full-size exits should be provided; window glass should remain intact when impacted; and more information on bus fires is needed.

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Melbourne, Australia
1973 ; 134p 64refs
Prepared for the Australian Dept. of Transport.
Availability: Corporate author

HS-017 094

EVALUATION OF THE EFFECTIVENESS OF TRAFFIC ACCIDENT COUNTERMEASURES [IN AUSTRALIA]

An initial stage of a program of studies of the effectiveness of traffic accident countermeasures based on a review and analysis of Australian and overseas research and practice is reported. Draft specifications are prepared for studies to assess both site and system effectiveness of the following devices or techniques: one way street schemes; turning bans; flashing lights at rural intersections; double (barrier) lines and narrow medians; STOP and YIELD signs; commercial center street closure; traffic signals (new and modified); and co-ordinated signal systems. An introduction to the concepts of traffic control devices and traffic management schemes is provided. The following specific topics are reviewed: the reporting of accidents; accident association and the interaction of countermeasures; accident rates and frequencies; side effects; system effects; and criteria for assessing safety. Proper treatment of exposure (the frequency of traffic events which may cause an accident) is vital to a meaningful evaluation of countermeasures. The nature, definition and measurement of exposure are considered in terms of the following: direct versus indirect measures (quantities other than traffic parameters); individual driver exposure versus exposure in a given area or location; and "wide" measures (considering all possible factors) versus "narrow" measures (considering only the possibility of collision with other vehicles). Some theoretical and empirical studies relating exposure to traffic volumes are described. The following methods of assessing countermeasure effectiveness are discussed in general terms: multivariate techniques; matched group studies; before and after studies; and theoretical and simulation studies. The before and after study technique is selected as being potentially the most effective

method for empirical analysis. Various aspects of the method are discussed including the choices of before and after periods, statistical controls, test variables, and statistical tests. The application of a simple simulation model to the assessment of countermeasure effectiveness is described. It is concluded that many previous investigations into the effectiveness of traffic accident countermeasures have been misguided and ill-defined. While draft specifications for studies of effectiveness have been prepared on the basis of present knowledge, these could be expected to alter considerably once further research has been carried out. The following research studies are suggested: definition and measurement of exposure to traffic accidents; a study using the traffic conflicts technique; studies using computer simulation models; and studies to obtain reliable, complete, and relevant data bases.

by A. S. MacLean; A. J. Richardson; K. W. Ogden; M. A. P. Taylor; Nicholas Clark
Nicholas Clark and Assoc., Melbourne, Australia
1974; 172p 94refs
Availability: Reference copy only

HS-017 095

UPPER ANCHORAGE POINT LOCATION FOR LAP-SASH SEAT BELTS

Optimum locations for wearer comfort of the upper anchorage point of a three-point seat belt are determined experimentally. Two experiments were carried out, the first in a simulated car in the laboratory and the second in four cars of different designs. In the laboratory 13 females and 9 males from the 5th, 50th, and 95th percentile height groups were tested in a simulated vehicle set-up, and acceptable areas in two-side-planes, 20 cm and 40 cm from the steering column center line, were found. Tests were also made to determine the effect of seat reclinations on acceptable areas. Results showed that a common area in the side planes, acceptable to the three percentile groups of both males and females exists, and increases with steering column-to-side-wall distance. Increasing the seat reclinations from the vertical had the effect of reducing the size of the acceptable areas. Results are applicable to other side-wall positions and configurations simply by linear interpolation. In the second experiment ten subjects (5th, 50th, and 95th percentile male and females) were tested in a Mazda Capella, Volkswagen 1300, General Motors HQ model Holden and LC model Torana with the aim of determining whether subjects maintained the same "acceptable area" in vehicles of different design. The common areas found in this experiment were smaller than those found in the laboratory simulation. The results of these experiments are compared with the allowable areas for attachment of the upper anchorage of the present British, American and Australian standards.

by E. R. Hoffmann; K. T. Mak
University of Melbourne, Human Factors Group, Melbourne, Australia
Rept. No. HF-20; 1972; 23p 8rcfs
Sponsored by the Dept. of Shipping and Transport, from Dec 1970-Feb 1971. On cover: "Location of Upper Anchorage Points for Lap-Sash Seat Belts."
Availability: Corporate author

HS-017 096

A CRITICAL APPRAISAL AND COMPARISON OF REACH CAPABILITY STUDIES FOR THE

DETERMINATION OF THE FUNCTIONAL ARM REACH BOUNDARIES APPLICABLE TO AUSTRALIAN AUTOMOBILE USE

Several previously published studies of arm reach range in which the subjects wore three-point seat belts are compared, the corrections necessary for application of previously reported data to present Australian specifications are shown, and the 95th percentile reach envelope for female and male automobile drivers is presented. The studies compared are: the Bullock study which measured the functional arm reach of 75 male and 35 female light aircraft pilots; the Stoudt study which recorded the functional arm reach of 50 male and 50 female drivers selected to approximate the body size distribution of the general driving population; the Halsegrave study which measured 20 male and 20 female subjects chosen as cross sections of the ranges of arm lengths; the Hamilton study which collated results from four different studies, each using 20 men and 20 women; and the Chaffee study which measured the functional arm reach of 30 male and 30 female subjects. Because of the differing methods of arranging the arm measuring device in relation to the subject, the only vertical plane common to all studies was the mid-sagittal plane. Some of the levels used in the separate studies are shown to coincide quite closely with those used by Bullock. A comparison can be made of arm reach boundaries from two or three horizontal planes. Analysis of various reach boundary comparisons suggests that had all researchers used similar experimental conditions, their data might have been almost identical. It is concluded that the boundaries defined by Bullock for Australian male and female light aircraft pilots should be accepted for application to Australian automobile situations because of the following facts: after incorporation of best-estimate corrections and consideration of the problems of comparing mixed with separate male and female samples, the reach boundaries defined by the various studies, in the areas for placement of automobile controls, are very similar to those of Bullock; Bullock's method of stratified random sampling for ensuring representability of the parent pilot population appears to have been more thoroughly undertaken than the methods described in other studies; while Bullock reported an accuracy of measurement of plus or minus 2 mm, no other researcher mentioned any determination of accuracy of measuring techniques; Bullock's experiments included measurements for both restrained and unrestrained arms over a much wider range of positions than used by any other researcher; and the experimental conditions used by Bullock were those which are required for definition of reach boundaries for the Australian driving population. Data defining the arm reach boundaries of 95% of the male and female populations are presented, and the boundaries reached at all levels and at all angles by both male and female populations are illustrated.

by Margaret I. Bullock
University of Queensland, Dept. of Physiotherapy, Australia
1973; 46p 9rcfs
Availability: Corporate author

HS-017 097

1974 NATIONAL TRANSPORTATION REPORT. APPENDIX. PROFILES OF PUBLIC TRANSPORTATION PLANS AND PROGRAMS

Detailed description and analysis of the public transportation data submitted by the 52 largest cities in the United States (U.S.) with 1972 population of 1/2 million or more are

presented in terms of these measures: per capita seat and passenger miles; net income per passenger mile; cumulative capital investment per capita; and total average annual cost per capita, per seat mile, and per passenger mile. For each of these measures, the data for each of the urbanized areas are shown graphically; and statistical descriptions are given which include the mean, median, standard deviation, and coefficient of variation. Some of the performance and financial measures are summarized and shown in frequency distributions. Principal objectives are: identification of some of the more important transit performance and cost variables; description of these variables, in both tabular and graphic form; and display of measures of central tendency and variation among urbanized areas, including the amount of dispersion in the data. Urban transit data are classified by supply (including both the level and quality of supply), demand, capital investment, and fiscal performance characteristics. Data for each of three time periods (1972, 1980, 1990) were submitted for each of the 241 urbanized areas in the U.S. with 1972 populations exceeding 50,000. The 52 areas with more than 1/2 million in population were analyzed in detail. These areas accounted for approximately 95% of all planned capital investment in public transportation between 1972 and 1990 in the 241 urbanized areas. The different modes of transportation (bus, rail, and commuter rail) are analyzed individually and they are compared, in general, for 1972, 1980, and 1990. General findings from the all-mode comparison include: a substantially larger percentage increase by 1990 in seat miles per capita for rail and commuter rail than for bus; a much larger percentage increase in passenger miles per capita for rail than for bus, but with an increase in commuter rail passengers per capita slightly less than for bus; a larger increase in seat miles per capita for rail and commuter rail than passenger miles per capita; a net income per passenger mile decrease greater for bus than rail; the total cost per seat mile comparable for rail and commuter rail, and about twice as expensive as a seat mile for bus; and the total cost of a passenger mile of service, in 1980, greatest for rail and lowest for bus.

Peat, Marwick, Mitchell and Co.

1975 ; 137p

Prepared for the Dept. of Transportation. See also HS-016 733.

Availability: Office of the Secretary, Dept. of Transportation, Washington, DC

HS-017 098

1975 AUTOMOBILE FACTS AND FIGURES

United States (U.S.) automobile industry statistics are presented along with a discussion of the problems of the automobile industry since 1973, caused by the energy crisis and rising vehicle manufacturing costs. Detailed statistics are presented for the following factors relating to motor vehicle use in recent years: factory sales by type of vehicle; U.S./Canada passenger car production; monthly U.S./Canada motor vehicle production; world motor vehicle production and assemblies; factory installations of selected equipment; U.S. passenger car retail sales; new registrations by states; 1973 motor vehicle registrations in 32 major urban areas; motor vehicle registrations by states; 1973 world motor vehicle registrations, cars in operation by model year in 1974; passenger cars in use by age; percent of households owning cars in 1973; household purchases of new and used passenger cars, 1968-1973; driver licenses by state; U.S. drivers by age, sex, and miles driven; vehicle ownership and gasoline expenditures for fiscal 1973; person trips by mode of transportation, purpose,

and income group; intercity passenger miles by mode of travel; 1972 trips of 100 miles or more by mode; number and percent of person trips and person miles of travel, by mode of transportation in 1969; passenger car use in 1969; home-to-work transportation modes by residence, household income, and occupation in 1969; traffic fatality rate for U.S. and selected countries; U.S. traffic fatality rates by states; vehicle miles of travel and average miles per vehicle; vehicle miles by state, model year, and household income; vehicle miles traveled on U.S. roads, streets, and highways in 1973; miles of interstate highway; fatality rate by highway system total/rural/urban; U.S. cars in fleets by type of business; estimated passenger and freight transportation expenditures; motor vehicle related employment by states; motor vehicle equipment manufacturing employment; automotive impact on businesses; motor vehicle industry employment and payroll for 1972; materials consumptions for 1973; U.S. passenger car exports for 1973; U.S. motor vehicle imports by country of origin; federal automotive excise tax for 1974; state highway tax revenues for 1974; and receipts and disbursements for highways. Statistics are also presented for the following factors relating to motor vehicle use for the past 20 years: world motor vehicle production; national retail automobile sales; motor vehicles retired by years; consumer installment credit for automobiles; motor vehicle taxes paid; and highway trust fund receipts and disbursements. Annual motor vehicles factory sales from U.S. plants from 1942 to 1974 are tabulated. U.S. registrations of privately owned vehicles from 1900 to 1974 and of privately and publicly owned vehicles from 1940 to 1974 are given. In addition, statistics for the following are presented: miles of U.S. roads and streets (1904-1973); traffic fatality rates (1913-1974); the spread of U.S. motor vehicle facilities in U.S. and abroad; and production and retail sales records and milestones.

Motor Vehicle Manufacturers Assoc. of the United States, Inc., 320 New Center Bldg., Detroit, Mich. 48202

1975 ; 72p refs

Availability: Statistical Dept., Motor Vehicle Manufacturers Assoc., 320 New Center Bldg., Detroit, Mich. 48202

HS-017 099

A COMPARISON OF COSTS AND BENEFITS OF FACILITIES FOR PEDESTRIANS. FINAL REPORT

The cost and benefits of facilities for improving pedestrian flow, safety, and environment in downtown areas and at grade separations are discussed. The various types of facilities and improvements (sidewalks, partial and full malls, arcades, displaced grids, and vertical separation, both above and below grade) are categorized along with their advantages and disadvantages. A general framework for estimating total facility cost over time is developed and examples of costs are provided. Various costs discussed are: facility construction costs; operation and maintenance costs; and the economic investment costs, as determined through the use of two different statistical cost/benefit methods (present value and equivalent uniform annual cost). Pedestrian trip attraction and generation are discussed in terms of factors influencing: the pedestrian trip origin-destination matrix; the number of trips; and pedestrian trip characteristics (terminal trips, business trips, shopping trips). The impacts of pedestrian facilities are considered in terms of safety and separation (accident risk, safety impact of separation, selected causal factors, cost of pedestrian accidents), pedestrian convenience (pathway impedance, pedestrian delay due to vehicles, the cost of delay, con-

venience and pathway attributes), and comfort and other impacts (security, environmental protection, coherence to pathway, and features of interest along pathway). Other impacts such as those on motorists and vehicles; abutting property, and businesses are discussed. The costs and benefits of pedestrian highway crossings are considered in general, and several examples of cost calculations for specific facilities with criticism of the facilities are given. Case studies of grade separated facilities are provided in the following central business districts: Montreal, Quebec; Toronto, Ontario; Minneapolis, Minnesota; Cincinnati, Ohio; and Lancaster, Pennsylvania.

by William G. Scott; Leonard S. Kagan
Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave.,
N.W., Washington, D.C. 20036; RTKL Assoc., Inc.
Contract FH-11-7966
Rept. No. FHWA-RD-75-7; 1973; 310p refs
Availability: NTIS

HS-017 100

MOTOR VEHICLE SIZES IN 1440 FATAL CRASHES

All motor vehicle related fatalities, including pedestrian, motorcyclist, and bicyclist deaths, in 1970-71, in Maryland, were examined by vehicle size, driver descriptives, and situational variables. There were 1440 fatal accidents in the two years resulting in 1583 deaths. The vehicle identification numbers, obtained from the automobiles involved, were decoded so that wheelbases could be determined. Wheelbase rather than weight was used as the indication of automobile size because size is more directly related to crash survival than weight. Of the 1152 fatal crash-involved automobiles registered in Maryland, numbers for 885 (77%) were decoded. Fatal crash involvement rates per 100,000 years registered were calculated by dividing the number of involved vehicles of a particular size by the number of years registered for vehicles of that size, and multiplying the results by 100,000. Occupant deaths per 100,000 years registered was substantially higher among smaller vehicles, but pedestrian deaths were higher for larger vehicles. Motorcycles, tractor-trailer trucks and cars with wheelbases of 105 inches or less respectively, had first, second and third highest deaths per years registered for occupants, riders, and pedestrians combined. Variations in driver descriptives or situational variables did not account for the relationship between size and fatal injury. More than 88% of the passengers, after exclusion of each index death, survived--suggesting that better energy management in terms of vehicle use might increase survival substantially.

by Leon S. Robertson; Susan P. Baker
Insurance Inst. for Hwy. Safety; Johns Hopkins Univ., School
of Hygiene and Public Health
1975; 26p 23refs
Availability: Insurance Inst. for Hwy. Safety, Watergate 600,
Washington, D.C. 20037

HS-017 101

DESIGN IN A TEXTILE REVOLUTION

Textile industry developments are discussed in relation to the interior design of automobiles. The first closed car with an all-steel body was introduced in 1923 facilitating the use of textiles instead of weatherproof materials in automobile interiors. Developments that led up to the use of vinyl-coated interior

are considered: leather, vinyl, headliner materials and floor covering materials. The high quality standards that textiles used in automobiles must meet, and new materials satisfying flame retardancy standards are discussed. The uses of tweed, velour, wool, and a few luxury fabrics are considered. Decorative and tactile capabilities of new synthetic materials have created a broad spectrum of possibilities for the future of interior design, including computerized interpretation of fabric and color combinations.

by Colin G. Neale
Chrysler Corp.
Rept. No. SAE-750338; 1975; 8p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 102

USE OF EQUIPMENT AND METHODS OF MAINTENANCE. SPECIAL REPORTS

Methods of maintenance and the use of equipment on maintenance projects are presented. The following methods are detailed: the "cushion-safe" under-ride and impact cushion system, (consisting of liquid filled tubular cells which dissipate crash energy; the Klarcrete concrete cutting and safe surfacer machines; the automatic truck cover; the poweray infrared asphalt heater used in patching potholes in cold weather; a truck-mounted spray system for guardrail vegetation control; fast setting concrete; Monroe's ZOR-X asphaltic patching material; an asphalt mobile machine; the Wirtgen milling machine; a precast concrete median barrier (found to be as durable as other forms of rigid concrete barriers, when struck by a 2,000 pound steel ball in impact tests); and the Cutler repaving process. A study of methods used to support highway signs conducted in Arizona is also reported. Signs used in New Mexico, Colorado, Utah, Nevada, and California were investigated for comparative purposes. After one year, the following sign utilization recommendations were made: truck or trailer mounted flashing arrow devices, capable of flashing left, right, or both sides; thin wall, one inch square tubing, folding signs with sandbags as optional support; standard barricades for semi-permanent signs; delineator type sign supports for short term signs; and barricade sign supports and sand bags for city work signs, or signs at slow speed work areas.

Federal Hwy. Administration, Maintenance Branch,
Washington, D.C. 20590
1975; 67p

Compiled from special reports covering the use of equipment and maintenance methods as requested in Federal-Aid Hwy. Prog. Manual, vol. 6, sec. 3, subsec 1, "Maintenance Inspection and Reporting", dated 23 Aug 1974.
Availability: Corporate author

HS-017 103

FATAL CRASHES AMONG MICHIGAN YOUTH FOLLOWING REDUCTION OF LEGAL DRINKING AGE

Lowering the legal drinking age in Michigan from 21 to 18 in 1972 was followed by a reported increase in the number of alcohol-involved fatal crashes, but no equivalent change in total fatal crashes, among drivers aged 18 to 20. The number of licensed drivers aged 18 and 19 and the number involved in

72. It is concluded that the post-1972 increase in "alcohol involvement" in fatal crashes more likely reflects a change in reporting practices than changes in driving after drinking behavior on the part of drivers aged 18 to 20; based on an analysis of the crash experience of 18- and 19-year-old drivers, the changes in actual numbers of young drivers involved in fatal crashes in Michigan since the advent of the 18-year-old legal drinking age appear to reflect normal year-to-year fluctuations; and most young adults deserve more confidence than the older generation has been willing to give them.

by Richard Zylman

Publ: Quarterly Journal of Studies on Alcohol v35 nA p283-6

(Mar 1974)

1974 ; 3refs

For correspondence and response, see HS-016 295.

Availability: See publication

HS-017 104

OAKLAND COUNTY IN-DEPTH COLLISION INVESTIGATION PROGRAM. FINAL REPORT

Field, accident investigations conducted in Oakland County, Michigan are described. A total of 258 in-depth investigations of accidents involving late model cars were conducted. From March 1, 1974 to July 31, 1974 data were collected on 230, 1973 and 1974 passenger cars for an evaluation of restraint system effectiveness. The principal sources of injury information on individual accident victims were participating physicians at cooperating hospitals. Vehicle categories selected for investigation were: 1974 passenger cars; 1972-1974 model year trucks (under and over 20,000 pounds) and multipurpose passenger vehicles; and buses of the 1964-1974 model years. Accident injury criteria in the order of highest priority were: at least one occupant admitted to a hospital, at least one occupant treated in an emergency room; or at least one occupant injured, but not taken to hospital. Photographs were taken of the interior and exterior of the vehicle and of the scene of the accident. Injury information on the occupants was obtained from the hospital or from the occupants themselves. Lists of the accident cases, case vehicle make and model, model year, Collision Deformation Classification, other vehicle make, model and year, and collision configuration are provided. The number of cases by model year are: 1970 (1); 1971 (28); 1972 (118); 1973 (102); and 1974 (4). Most cases were not completed because of the pressures of the restraint system effectiveness study. All candidate vehicles from which at least one occupant was taken to the hospital were sampled at 100%. Non-hospital cases were sampled at a rate of 30% of all 1973 vehicles, and 50% of all 1974 vehicles. Principal data collected were: vehicle identification, collision type, vehicle damage, injury description, occupant description, and restraint system status and usage. The distribution of the 230 cases, studied by occupant disposition, was: 58 hospitalized occupants in 1973 vehicle; 40 hospitalized occupants in 1974 vehicles; 72 non-hospitalized occupants in 1973 vehicles; and 60 non-hospitalized occupants in 1974 vehicles. No conclusions are made. A list of the cases and a field data form used in the restraint system effectiveness study are provided.

by Robert E. Scott

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48105

Rept. No. UM-HSRI-SA-75-10; VRI-6.1 ; 1975 ; 43p 5refs

Rept. for 1 Feb 1973-31 Mar 1974. Sponsored by the Vehicle Res. Inst. of the Society of Automotive Engineers.

Availability: Corporate author

HS-017 105

SMALL TRANSIT VEHICLE SURVEY. FINAL REPORT

The specifications and operating experience of small transit vehicles (those seating 7-25 passengers, intended for public use) available in the United States (U.S.) are documented. A summary of the availability and operational experience of small transit vehicles is provided. Vehicles are divided into three main categories: vans and van conversions, small buses, and converted motor homes. Each of the small transit vehicles is discussed. Operating experience is discussed with emphasis on the number of vehicles, type of use, vehicle age, daily usage, and general findings reported by the operators. In addition to the main categories, some discussion is given to discontinued vehicles and planned models. A list of the users of these vehicles and a comparison of the technical specifications for each of them is provided. No vehicle has been completely free of problems or clearly superior to others. A vehicle operator must weigh a number of variables before determining which vehicle is best for a particular application.

by Martin Flusberg; Brian Kullman; Robert Casey
ECI Systems, Inc., 1050 Massachusetts Ave., Cambridge, Mass. 02138; Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142
Contract TS-7769

Rept. No. DOT-TSC-OST-75-17 ; 1975 ; 138p refs

Rept. for Jan-Mar 1974.

Availability: NTIS

HS-017 106

MOTOR VEHICLE NOISE CONTROL. PROCEEDINGS OF A WORKSHOP HELD DECEMBER 10-11, 1974, IN WASHINGTON, D.C.

The stated purposes of the workshop were: to assist those concerned with highway traffic noise in developing a broader perspective on how the problem can be solved; to specifically examine in some depth the present activities and state of progress on the source control, direction of attack; to appraise the extent of overall traffic noise reduction that is possible and that can be reasonably expected to result from vehicle source control in the future; and to identify and describe actions that can be taken by federal, state, and local governments and industry to control vehicle noise. Presentations were delivered on the following matters: vehicle noise sources and noise-suppression potential; the effect of motor vehicle regulations on highway noise levels; timetables and obstacles for source control in the city of Chicago; the timetable for vehicle noise reduction; the extent to which motor vehicle noise should be regulated; standards development as a factor in motor vehicle noise abatement; balancing concerns in the development of regulatory noise control; a federal perspective of enforcement of control of interstate motor carrier noise: noise control strategies for new and in-use trucks; evaluation of the effects of motor vehicle noise regulations on population; a status report on the Florida motor vehicle control plan; vehicle noise control program of the New Jersey Turnpike Authority; and development of a program to control motor vehicle noise in Maryland.

Transportation Res. Board, 2101 Constitution Ave., N.W.

Washington, D.C. 20418

Rept. No. TRB-SR-152 ; 1975 ; 109p refs

Sponsored by the Subcom. on Transportation-Related Noise,

HS-017 107

VEHICLE HANDLING: ITS DEPENDENCE UPON VEHICLE PARAMETERS

The following aspects of the vehicle directional control problem are discussed: steady state characteristics (geometry of a turn, neutral steer, interpretation, understeer and oversteer, characteristic and critical speeds, and stability); nonlinear tire forces; the axis system, and mathematical model which are used for the analysis; transient response (linear transient response, and independence of tire and vehicle parameters); path response; tire forces applied to the vehicle; nonlinear response; the effect of chassis parameter changes on nonlinear response (roll understeer, roll rate distribution, roll axis height, roll axis inclination, and center of gravity location); and the effect of vehicle speed. The results discussed were obtained from an analog computer simulation of the vehicle. The mathematical model is a set of three simultaneous differential equations which describe the directional control motion of the vehicle. Reference steer angle is plotted as a function of lateral acceleration for a constant speed and a constant radius test. A schematic of a vehicle in a turn is given showing the geometry of a turn, including slip angle and roll steer effects. In the constant radius test, the steer angle required at zero lateral acceleration for a 100 foot radius curve is 4 times the steer angle required at zero lateral acceleration for the 400 foot radius curve. For the constant speed test the slope of the neutral steer line for 30 mph is 4 times the slope for 60 mph. The effect of understeer and oversteer for the constant speed and constant radius tests are plotted. The effect of slip angle and normal force on lateral force is shown using a carpet plotting technique for a 7.60 x 15 tire with 28 pounds per square inch inflation pressure and zero inclination angle. The lateral force as a function of slip angle and normal force for four different brands of original equipment tires is shown. The directional control axis system is illustrated in the following manner: X-axis (roll motion, longitudinal motion); Y-axis (pitch motion, lateral motion); and Z-axis (vertical motion, yaw motion). The following transient responses are shown for a linear model in which tire forces and moments are represented as linear functions of slip and inclination angle: yaw velocity, sideslip angle, roll angle, and lateral acceleration (to 8 feet per second per second). The effects of tire parameters on linear transient response is shown. The relationship between the moving axis system, which is used to describe the motion of the vehicle, and the fixed axis system, which is used to describe the position of the vehicle, is demonstrated. Path response for step input of steer angle and the path transient responses of three sets of tire responses are shown. The steady characteristics, transient response for steer angle, step inputs, and path transient response for a 4800 pound reference vehicle are plotted. The effects of roll understeer, roll rate distribution, roll axis height, roll axis inclination, center of gravity location at 30, 60, and 90 mph, and vehicle speed (30, 60, 90 mph) on vehicle directional control are plotted for the model vehicle and reference vehicle with the parameters of a typical medium-sized American car.

by Donald L. Nordcen
General Motors Res. Labs., Engineering Mechanics Dept.,
Warren, Mich.
Rept. No. GMR-423 ; n.d. ; 43p 6refs
Availability: Corporate author

HS-017 108

CATALYTIC CONVERTER: SERVICE, THE LAW, AND THE FUTURE

The new catalytic converters (CC) (the Chrysler and Ford "monolithic" type, and the General Motors and American Motors pellet type) installed in 1975 American cars are discussed. The catalytic converters are made of stainless steel to last 50,000 miles. They provide no silencing effect so that cars equipped with them require dual mufflers, resonators and attenuators installed behind the CC's to meet 1975 federal noise standards. Unleaded fuels must be used because the lead in conventional gasoline slowly poisons the CC. Certain necessary service precautions are considered for CC-equipped cars, relating to the system's heat and tendency to collect unburned fuel. Several technical terms (catalytic converter, pelletized converter, monolithic converter, substrate, catalyst, platinum, palladium, attenuators, diffusers, and light-off temperature) involved in the use of the new CC's are defined and explained. The Environmental Protection Agency's (EPA) new car certification test for CC's (23-minute "cold start" test, prescribed driving cycle, and 15-minute shutdown and restart), required for meeting the 1975-1976 emission standards, is considered. The political problems in CC implementation (varying EPA regulations, and the discovery of the production of toxic sulfur compounds by the CC's) are discussed.

by Art Perrow
Publ: Motor Service p30-3, 46, 61 (Jul 1975)
1975
Availability: See publication

HS-017 109

THE LOW-SULFUR UNLEADED GASOLINE PROBLEM

It has been reported that automobile exhaust resulting from unleaded gasoline containing sulfur can produce a potentially harmful sulfuric acid mist, when passed through an oxidation catalytic converter. An industry survey is discussed which was conducted by the National Petroleum Refiners Association (NPRA) in response to an Environmental Protection Agency (EPA) request to develop information concerning the impact of reducing the sulfur in unleaded gasoline to a maximum of 100 parts per million (ppm). Brief consideration is given to the refining process itself and the various gasoline components (butane, straight-run gasoline, reformate, cracked gasoline, and alkylate). A schematic for a desulfurized gasoline production process is offered. Survey questionnaires were sent to each petroleum refining company and responses were received from companies operating 148 refineries. It is projected that a \$3.7 billion industry capital investment and 361 facilities would be needed in the period 1974-1980 for the manufacture of low-sulfur (100 ppm) unleaded gasoline. An additional 100,000-150,000 barrels a day of crude oil would be consumed by the additional processing required and no increase in real refining capacity would be realized. It is concluded that such a process simply requires too much money, manpower, material, and energy.

by Ronald G. Bruce
Continental Oil Co.
Rept. No. SAE-750092 ; 1975 ; 7p 3refs
Presented at the Automotive Engineering Congress and

HS-017 112

CHILDREN IN TRAFFIC. REV. ED.

A comprehensive discussion of the problem of children and traffic is presented. Statistical information is provided on child accidents in Sweden during 1968-1969, determining categories of road users, distributions of accidents by age and sex, the child's injury, accident distribution (by month, age and sex in relation to the monthly distribution, days of the week, and variations in time of day), pedestrian's field of vision, location of the accident site, factors of accidents at pedestrian crossings, behavior pattern of drivers, traffic light factors, legal indictments, number of and field of vision in bicycling accidents, driver's age, sex and length of time driver's license had been held, and the child's injury in relation to driver's age. Other studies investigated the following: the playing habits and playing areas of young children, the outside playtimes of pre-school children in relation to the type of housing area, the determination of the location of play, distance from home, and the relation between choice of play area, the construction and housing environment, and the visiting habits of children to a municipal park, the spontaneous behavior of young children in traffic; behavioral studies based on studies of play habits; the peripheral vision of children and adults; sound location by children and adults; the ability of children to understand traffic signs, response to traffic signs by age, sex, experience in automobiles, the use of traffic toys and questions about signs already in use, and the testing of four new warning signs for children crossing at school or playground; children's understanding of traffic terminology, the effect of family car ownership and child cycle ownership on the children's knowledge of traffic signs, and simple traffic terms and synonyms; traffic safety education for pre-school children in different countries, and teaching elementary traffic rules. The results of other research are summarized and discussed: children's needs for games and movement, the physical deficiencies of children, the problems of dividing attention, problems of instruction, and training implications; proposals for basic traffic training, in the home, in kindergartens and day nurseries, in primary school, and in teacher training; and the necessity of adapting "traffic to children" as opposed to "children to traffic".

by Stina Sandels
Institute for Child Devel. Res., Stockholm, Sweden
1975 : 168p 63refs
Availability: Elek Books Ltd., 54-58 Caledonian Rd., London
N1 9KN, England

HS-017 115

**URBAN TRANSPORTATION DECISION-MAKING.
[SUMMARY AND CONCLUSIONS] FINAL REPORT**

Interpretative and analytical information on the transportation decision process is presented for the following major cities: Minneapolis/St. Paul, Miami/Dade County, and Seattle in America; Toronto and Montreal, Canada; Hamburg, Germany; Manchester and Leeds in England; Stockholm and Gothenburg in Sweden; and Amsterdam, Holland. The following areas of effort are elaborated: an attempt to place transportation problems of American, Canadian, and European cities in a more general context of national urban policies; a discussion of the institutions for broad definition existing in the cities and nations (how goals are defined and what the linkages are to the implementation process); discussion of the institutions specifically concerned with transportation planning and pro-

grams in the cities (parent-government transportation agencies, metropolitanization of urban public transport activities, local roads planning agencies, traffic, and parking); a discussion of the policy outputs or approved existent programs in the cities (a model of transportation policy evaluation, policy changes from 1945 to 1970, trends in transportation policy, context of metropolitan policies, and contemporary policy changes); relating evaluation of policy to the evaluation of institutional policy (a model of institutional policy evaluation, institutional decisions, and programmatic output); and conclusions and recommendations (reform at the metropolitan area, territorial coverage of metropolitan governments, powers of the metropolitan decision-making body, citizen participation, and the federal role). Descriptions and graphic models of the organizational structures for urban transportation policy-making in the 13 cities are appended in terms of the following: inputs (citizens, citizen groups, and private interest groups); the conversion process (political parties and the decision-making organization, including politicians and bureaucrats); and the outputs (policies) and feedback into the system.

by Frank C. Colcord, Jr.
Tufts Univ., Medford, Mass. 02155
Contract DOT-OS-30036
1974 : 184p 212refs
Rept. for Jan 1974-Feb 1975. See also HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).
Availability: NTIS

HS-017 116

**URBAN TRANSPORTATION DECISION-MAKING.
MIAMI-DADE COUNTY: A CASE STUDY. FINAL
REPORT**

The urban transportation decision processes in Miami/Dade County, Florida are described. Main areas of discussion are: the historical background of Miami/Dade County; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, and buses); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that although Dade County has been unable to avoid inadequacies in several aspects of its transportation planning process, most notably its integration with the state's highway planning process and its correlation to a county-wide land use plan, the county has achieved notable successes, such as the county-wide rapid transit plan. Metropolitan government has brought a new level of rationality and responsiveness to the area's planning for and provision of transportation services.

by Frank C. Colcord, Jr.; Steven M. Polan
Tufts Univ., Medford, Mass. 02155
Contract DOT-OS-30036
Rept. No. 4 : 1973 : 75p 29refs
Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).
Availability: NTIS

HS-017 117

URBAN TRANSPORTATION DECISION-MAKING. ATLANTA: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Atlanta, Georgia are described. Main areas of discussion are: the historical background of Atlanta; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, and buses); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that the Atlanta region has made major institutional advances toward responsive, multimodal transportation planning, although the crucial test of the capability to integrate that planning with comprehensive planning is yet to come.

by Frank C. Colcord, Jr.; Steven M. Polan
Tufts Univ., Medford, Mass. 02155
Contract DOT-OS-30036

Rept. No. 5; 1973; 64p 34refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 118

URBAN TRANSPORTATION DECISION-MAKING. MINNEAPOLIS-ST. PAUL: A CASE STUDY. FINAL REPORT

The urban transportation decision processes in Minneapolis-St. Paul, Minnesota are described. Main areas of discussion are: the historical background of Minneapolis-St. Paul; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, and buses); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that the transportation planning process in Minneapolis-St. Paul is well advanced, beyond that which exists in most other urban areas, although there is some conflict and confusion resulting from a lack of coordination among the various planning agencies.

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Contract DOT-OS-30036

Rept. No. 6; 1973; 56p 47refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 119

URBAN TRANSPORTATION DECISION-MAKING. SEATTLE: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Seattle, Washington are described. Main areas of discussion are: the

historical background of Seattle; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, and buses); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Seattle suffers from the same lack of coordination among the various transportation planning levels as other major urban areas in the United States. There are no strong executives with sufficient authority to resolve the controversial issues.

by Frank C. Colcord, Jr.; Ronald Lewis
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Contract DOT-OS-30036

Rept. No. 7; 1974; 139p 80refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 120

URBAN TRANSPORTATION DECISION-MAKING. MONTREAL: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Montreal, Canada are described. Main areas of discussion are: the historical background of Montreal; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, buses, subways, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Montreal is far ahead of any American city in terms of the manner in which it meets the mobility needs of its population, although the adequacy of its planning policy has depended almost entirely on one man, the mayor. The slow evolution of regional institutions, that is becoming evident now in the Montreal area, is seen as a highly desirable trend.

by Frank C. Colcord, Jr.; Steven M. Polan; John Brouder
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Contract DOT-OS-30036

Rept. No. 8; 1973; 122p 34refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 121

URBAN TRANSPORTATION DECISION-MAKING. TORONTO: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Toronto, Canada are described. Main areas of discussion are: the historical background of Toronto; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and

statistics (road and highway use, buses, subways, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Toronto is a well and democratically run city that has dealt effectively with its problems through hard work and open minds.

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Contract DOT-OS-30036

Rept. No. 9; 1974; 122p 39refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 122

URBAN TRANSPORTATION DECISION-MAKING. MANCHESTER AND LEEDS, ENGLAND: CASE STUDY.

The urban transportation decision processes in Manchester and Leeds, England are described. Main areas of discussion are: the historical background of Manchester and Leeds; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, buses, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: whereas in Manchester transportation policy-making is traditionally the business of the functionally responsible officials with little interaction with politicians or public (close to the situation found in large American metropolitan areas), a clear-cut and comprehensive policy has evolved in Leeds whose formation is not limited to the decisions of transportation officials.

by Frank C. Colcord, Jr.; Ronald Lewis

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Contract DOT-OS-30036

Rept. No. 10; 1974; 147p 34refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 123

URBAN TRANSPORTATION DECISION-MAKING. STOCKHOLM [AND GOTHENBURG]: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Stockholm, Sweden are described. Main areas of discussion are: the historical background of Stockholm; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, buses, subways, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Stockholm has

developed one of the finest, most extensive, rational, multi-modal transportation system in the world, despite a lack of coordinated planning on all governmental levels. The success of the Swedish planning system in the past has been due to its able, professional bureaucracy. Now the bureaucracy is opening itself up to citizen participation, and politicians are more concerned with issues like planning and future transportation needs.

by Frank C. Colcord, Jr.

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Contract DOT-OS-30036

Rept. No. 11; 1974; 181p 37refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 124 (no. 12), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 124

URBAN TRANSPORTATION DECISION-MAKING. HAMBURG: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Hamburg, West Germany, are described. Main areas of discussion are: the historical background of Hamburg; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, buses, subways, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Hamburg's achievement in dealing with the problem of coordination of the individual agencies involved in public transport is the city's greatest transportation success.

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Contract DOT-OS-30036

Rept. No. 12; 1974; 102p 47refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), and HS-017 125 (no. 13).

Availability: NTIS

HS-017 125

URBAN TRANSPORTATION DECISION-MAKING. AMSTERDAM: CASE STUDY. FINAL REPORT

The urban transportation decision processes in Amsterdam, Holland are described. Main areas of discussion are: the historical background of Amsterdam; socio-economic factors, such as population density, distribution of income, and location of service and manufacturing sectors; the political system (local, regional and national); general transportation factors and statistics (road and highway use, buses, subways, and trains); the interaction of political and institutional structures involved in transportation planning; and transportation planning controversies. It is concluded that: Amsterdam has arrived at a crossroads in transportation planning by a combination of factors over which it has no control; and it will have to resolve them, in collaboration with national officials,

through the political process. The growing role of the national government is likely to stimulate a more rapid response than might otherwise come, but the decisions will still be largely responsive to local forces.

by Frank C. Colcord, Jr.; Ronald S. Lewis
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Contract DOT-OS-30036

Rept. No. 13; 1974; 119p 29refs

Rept. for Jan 1974-Feb 1975. See also HS-017 115 (Summary and Conclusions), HS-017 116 (no. 4), HS-017 117 (no. 5), HS-017 118 (no. 6), HS-017 119 (no. 7), HS-017 120 (no. 8), HS-017 121 (no. 9), HS-017 122 (no. 10), HS-017 123 (no. 11), and HS-017 124 (no. 12).

Availability: NTIS

HS-017 126

CONNECTORS GET THE VEHICLE MARKET WIRED

The development is described of economical, long-lasting environmental (weatherproof) connectors for truck anti-skid braking systems, satisfying Federal Motor Vehicle Safety Standard 121 (heavy duty trucks must be able to brake to a stop within certain specified distances and lane width). It was found that these connectors could be beneficial in the following other areas: tractor-trailer air conditioning units; electronic controls for engine emissions, solid-state timing devices, fuel injection; electronic sensing for fuel saving systems; police vehicle identification systems; and fluid level sensors in heavy farm and construction equipment. Various types of wiring are discussed (the jacket type, boot type, and seals to each individual wire insulation made from a special nitrile rubber compound). Contacts are stamped from preplated (90% tin, 10% lead finish) high tensile copper alloy. All sockets are equipped with stainless steel hoods to increase their resistance to probe damage and connector bending during mating and unmating. Testing for the current Sure-Seal connector now in operation on trucks and cars included: electrical, mechanical and environmental requirement testing; testing covered shock, vibration, temperature, durability, fluid immersion, insulation resistance, and ultraviolet and weatherometer simulated five year durability. New developments and demands in connector manufacturing are discussed.

by Gerald J. Selvin

Publ: Automotive Industries v152 n12 p19-21 (15 Jun 1975)
1975

Availability: See publication

HS-017 127

LRM [LIQUID REACTION MOLDING] SYSTEM FOR SOFT BODY PARTS

The production of liquid reaction molding (LRM) urethane automobile parts is discussed. Liquid reaction molding is capable of mixing two or more liquid streams of a total weight of 30 pounds per head and injecting it into a mold in a few seconds on an intermittent basis. In testing, six-pounds LRM urethane Chevy Monza rear lower fascia parts were produced and demolded in one minute. The soft fascia material helps meet impact, safety, and damageability standards, while saving weight (as high as 80 to 100 pounds less). Microcellular urethanes provide superior, low temperature properties, excellent resistance to dinks, dents, and corrosion, and excellent paint adhesion. The LRM system's styling versatility far outstrips that of

heavy, protruding impact-absorbing bumpers and it weighs less than the front and rear end metal it replaces. The material and equipment costs of the microcellular urethane soft body parts compare favorably with other soft-front systems. The ability to restyle the shell for model changes without having to re-engineer the energy-absorbing device hidden behind it is yet another economical factor.

Publ: Rubber Age v107 n7 p46-8 (Jul 1975)
1975

Availability: See publication

HS-017 129

VEHICLE SAFETY LEGISLATION AND INTERNATIONAL TRADE--PROBLEMS AND SOLUTIONS

International agreements on uniform safety standards and type approvals for equipment are discussed. The Economic Commission for Europe (ECE) system, applied by 16 countries, in which 46 safety regulations have been completed, is described. The European Communities (EC) system has been adopted, using the technical substance of the ECE regulations. Examples of some international safety regulations under both systems are presented. Solutions for a gradual approach to safety standards are outlined for those countries which, because of their legislative structure, are presently not in a position to enter into formal international agreements. Problems involved in vehicle traffic across borders, and international trade in vehicles and equipment are discussed. Under the ECE system regulations can be applied in the following ways: they can replace existing national rules by mandatory application; they can be applied as an alternative to such rules at the choice of the manufacturer; or they can simply be set up on the national level to open a possibility for approval at the demand of manufacturers. In contrast, under the EC system, member countries are obliged to amend their national rules in such a way as to comply with a directive of the EC commission. The transformation of international regulations into national law is discussed, with emphasis on West Germany. The following examples of international safety regulations are considered: the installation of lighting and light signalling devices involving provisions for presence, number, position on the vehicle, geometric visibility (expressed as observation angles for the apparent surface), orientation, grouping or combination with other devices, electrical connections, and additional requirements; and the interchangeability and compatibility of articulated vehicles' tractor and trailers (defining dimensional values for the mechanical connecting pieces and mounting dimensions which guarantee free movement between trucks and trailers, and tractors and semi-trailers; and specifications for electrical connections and braking systems). Possibilities for world-wide safety standards are discussed. In addition, charts are presented to show the following: 1974 vehicle registrations by country of vehicle manufacture, for West Germany, France, Italy, the United Kingdom, the United States, and Japan; the committee structure, and a schematic of regulation, and amendment procedures of the ECE and the EC; and the type approval system used by West Germany.

by Dieter Matthes

Verband der Automobilindustrie e. V. (VDA), West Germany
1975; 52p

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-017 745

HS-017 130

VEHICLE SAFETY IMPROVEMENTS USING VEHICLE CHARACTERISTIC RATINGS

A concept for a sequence of logical steps for the development of a Motor Vehicle Safety Standard is outlined. An important aspect of the concept is the utilization of a system of vehicle rating characteristics (Vehicle Characteristic Rating, VCR) accounting for the relative importance of non-safety factors and the impact that changing one factor has on all the others. An attempt is made to show the potential of combining competitive vehicle manufacturer action, efficient government regulation, and informed consumer choice, to improve vehicle safety. Various economic (inflation) and resource (gasoline and large vehicle) costs, social changes (intensified public concern), and constitutional considerations (restraint system laws) that affect the implementation of safety standards are mentioned. The procedure for developing standards is described by the following steps: determination of the problem (collection of accident, vehicle damage, and injury information); identification of possible solutions; selection of optimum solution (computer analysis, and hardware testing); implementation of solution (voluntary manufacturer action, and promulgation of safety standard); evaluation of solution (in terms of field studies and related VCR's); modification process (vehicle improvements by manufacturer, modify safety standard, and develop new VCR's). Improved damageability, vehicle bumpers and vehicle occupant restraint systems are discussed to illustrate needs for viable alternatives to currently used systems.

by Michael R. Appleby; Louis J. Bintz
Automobile Club of Southern California, Automotive
Engineering Dept., 2601 South Figueroa St., Los Angeles,
Calif. 90007
1975 ; 10p 22refs
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 131

TOMORROW'S AUTOMOBILE SAFETY AND THE ROLE OF LEGISLATION

The inadequacy of legislation concerning automobile safety standards is examined with emphasis on standards for side door strength and bumpers. Recommendations and guidelines for promoting automobile safety need to be developed through lengthy deliberation. It is recommended that: only the most important items be upgraded to actual standards, after sufficient assessment of the cost benefit, and consideration of natural resources, economics, and technology; the application of the items included in guidelines and recommendations to production models be left to the choice of the manufacturers or the market demand; accident surveys be used to evaluate items applied to production models in the field; and more emphasis be placed on driver education and environmental improvement. The Motor Vehicle Safety Standards (MVSS) for the following items are evaluated: side guard bar, occupant restraint systems, bumpers, collapsible steering columns, headrests, roof intrusion, seat reinforcement, lamp devices, and tires. The need for international MVSS standardization is

stressed. Projections regarding automobile automotive safety in the future are presented.

by Yoshio Serizawa
Nissan Motor Co., Ltd., 17-1, 6-Chome, Ginza, Chuo-ku,
Tokyo 104, Japan
1975 ; 25p
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 132

STATE PARTICIPATION IN THE DEVELOPMENT OF FEDERAL MOTOR VEHICLE SAFETY STANDARDS AND PROGRAMS

An attempt is made to describe problems in the method of promulgating federal standards from the point of view of a state regulatory agency. It is pointed out that federal standards tend to nullify state laws of proven value and that there is a lack of minimum performance standards which lend themselves to enforcement for vehicles in use. Conclusions indicate the need for: nationwide uniformity of minimum vehicle equipment standards; performance standards which can be readily adapted to a highway safety enforcement program; the avoidance of federal preemption of state laws of proven merit, unless such action has been thoroughly studied and justified; state government and industry discussion of all aspects of each new proposal, prior to adoption; and full consideration and a written response to petitions from knowledgeable individuals. Cost benefit to the consumer should also be thoroughly examined before adoption of new safety standards.

by G. B. Craig
California Hwy. Patrol, Commercial Vehicle Section
1975 ; 7p
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 133

SOCIETAL COSTS OF MOTOR VEHICLE ACCIDENTS FOR BENEFIT-COST ANALYSIS: A PERSPECTIVE ON THE MAJOR ISSUES AND SOME RECENT FINDINGS

The conceptual and methodological issues related to the development of the societal costs of traffic accidents are discussed. Two societal cost elements, medical costs and productivity loss, are described which can be applied to future National Highway Traffic Safety Administration (NHTSA) benefit-cost analyses. The background of the concepts and measurement of societal costs is discussed. Also discussed are: the basic concept of total societal cost; monetary benefits versus quantified effectiveness; and the need for benefits for the statistically average individual. The average costs by injury severity resulting from a 1972 study, and analysis of societal costs (productivity, medical, property damage, legal and court, insurance administration, and pain and suffering) are presented. The abbreviated injury scale and the permanent impairment index of the comprehensive injury scale are discussed in terms of their potential for direct use in estimating productivity losses. The problems involved in medical cost and productivity loss measurement are considered. Basic factors and results are presented of calculations of direct produc-

tivity loss by age group for 1973 motor vehicle fatalities. The values for direct productivity loss are shown to be 40% higher in 1973 than 1971, due in part to differences in precision of the method of calculation, and the passage of time.

by Barbara M. Faigin
National Hwy. Traffic Safety Administration, Office of Prog. Planning
1975 ; 18p 17refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 134

SOCIETAL COSTS, AND THEIR REDUCTION BY SAFETY SYSTEMS

A methodology is presented that permits a detailed calculation of the benefits to be gained by a particular safety system. It is based on a subdivision of the injury population, utilizing various accident files. Primary subdivision occurs according to vehicle class, accident mode (principal damage area), and barrier equivalent velocity (which is based on vehicle velocities, masses, and eccentricity of impact). Societal costs are assigned according to injury severity, and are based on recently reviewed health care and hospital cost information. Having thus established a baseline societal cost calculation for the current vehicle and traffic environment, the methodology then proceeds to calculate how various safety systems would reduce societal costs, by way of computing the reductions in accident frequency, injury severity, or both. Safety systems considered are: impaired performance detectors (IPD) (drunkometers, which reduce frequency); improved brakes with or without radar (which reduce both frequency and severity); and structure and/or restraint improvements (which reduce severity). The methodology calculates net benefits (societal benefit minus expenditure) for various combinations of these systems, forcing them to compete for the available benefit. The safety system combinations are rank-ordered accordingly, thus providing a rational way to determine implementation priorities. The top safety package was found to have 0.9 g driver-activated brakes, front-seat airbags, lap belts in the rear, and a 50% effective IPD. The package would have a yearly benefit/cost ratio of 3.6. The benefits are not total of the benefits produced by each system alone, but the true, total benefit of the package as a whole.

by Donald E. Struble
Minicars, Inc.
1975 ; 89p 59refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 135

SAFETY STANDARDS FOR A SPECIAL MARKET: THE HANDICAPPED DRIVER

The need for safety and performance standards for the special driving equipment required by handicapped drivers is examined. Special equipment for entry, seating, and driving are discussed. Where such devices are commercially available, they are generally manufactured by small businesses and then added to a vehicle. Federal Motor Vehicle Safety Standards do not have to be met. Manufacturers are actively engaged in marketing handicapped driver aids but do not acknowledge

having evaluated them. State licensing and motor vehicle inspection programs do not have any specific methods for judging driver aids but rely on a "common sense" approach. It is concluded that there is clearly a need for safety standard development in handicapped driver equipment and strong interest expressed by rehabilitative organizations. The National Highway Traffic Safety Administration should oversee the coordination of efforts and centralization of automotive safety activity regarding the handicapped driver.

by William A. Hyman; Make McDermott, Jr.; Arthur M. Sherwood; Paul H. Newell, Jr.
Texas A and M Univ., Bioengineering Prog.
1975 ; 7p
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 137

PROPOSAL OF METHODOLOGY FOR DRAWING UP EFFICIENT REGULATIONS

Present methods of traffic accident classification, analysis, and automobile testing are discussed to determine the level of protection offered and the costs of decisions made. Proposals for the adoption of new methods are also made. The recording of traffic accidents is discussed in terms of statistical collection, resolving the problem on the technological level by detailed analysis, detailed police accident reports, medical reports by doctors, and reports by engineers on the state of the vehicle involved. The following physical parameters on which the methods of accident analysis must be based are discussed: speed variation during the violent phase of the collision; vehicle deformation index; energy dissipation; and stress/deformation and energy/deformation laws in collisions. Using changes in velocity measured by a crash recorder and changes estimated by investigating teams, compared for 20 actual accidents, methods of accident classification are discussed. The method of choosing automobile tests, testing conditions, and criteria for evaluating results are considered. The final decision made regarding a traffic regulation should concern only the degree of safety, since the types and conditions of tests are decided by the reality of the traffic situation. The degree of safety aimed for in a regulation can be decided in either of the following manners: test speed (to cover a more or less high percentage of actual change in collision velocity); and/or protection criteria (to decide the more or less severe criteria, depending on the percentage of the population desired to be protected). The following conclusions are presented: analyzing accident reality cannot stop at the vehicle deformation index, which is an intermediate parameter for more sophisticated calculation; change in velocity during collision, and especially mean deceleration, are significant parameters; for frontal collisions, traffic accident reality suggests abandoning the non-representative symmetrical orthogonal test for an asymmetrical test of the 30 type, but not in collision tests with a fixed and rigid obstacle; and decision criteria must also be based on reality and should be made in terms of protecting everyone, although this is difficult because of the complexity and diversity of the people involved.

by Philippe Ventre
Regie Nationale des Usines Renault, France
1975 ; 22p 12refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

A PROGRAM TO EVALUATE ACTIVE RESTRAINT SYSTEM EFFECTIVENESS

The design, implementation, and proposed analyses are presented for a statistical study of accident restraint system performance in accidents. The criteria for data files necessary for statistical analysis of the injury-reducing effectiveness of restraint systems are that data must: be a large probability sample; contain information on those items other than belt usage having a significant effect on the injury rate; contain data from various geographical areas, with well defined sampling criteria; be a complete and accurate sample with a minimum of missing cases and missing data elements; and use a sophisticated measure of injury severity. Shortcomings of previous studies, with regard to these criteria, are discussed, and the design for a data file is explained, emphasizing topics relevant to satisfying the criteria. The file is a stratified, probability sample of 15,000 automobile occupants, taken from police-reported towaway accidents for 1973-1975. These accidents are sampled in five widely scattered geographic locations. Multidisciplinary accident investigation (MDAI) teams collected the data in order to increase accuracy, especially of seat belt usage reporting. The large sample size was made possible by limiting data to what was needed for analysis. Injury costs are considered as a means of quantifying injury severity. The method used by the MDAI teams to implement the sampling plan is described, and proposed analyses are given. Special attention is given to possible combinations of the theory of survey sampling and multivariate analysis, for the purpose of control and measurement of seat belt effectiveness. Analyses are also proposed to determine belt usage and effectiveness for subsets of the crash environment, and to study belt system defeat, malfunction, maladjustment, and seat belt-caused injury. Although data collection is incomplete, preliminary results indicate that lap and shoulder belts reduce injury by approximately 48%, and lap belts alone by approximately 30%.

by Charles J. Kahane; Scott N. Lee; Russell A. Smith
National Hwy. Traffic Safety Administration, Office of
Statistics and Analysis; Catholic Univ. of America, Dept. of
Civil and Mechanical Engineering
1975 ; 29p 29refs
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

PRACTICAL ASPECTS OF CHILD SAFETY RESTRAINT SYSTEM STANDARDS

Factors involved in developing child restraint systems (CRS) for automobiles are discussed. Some CRS which meet the static test requirements of the present child safety seating standard have been shown to structurally collapse under the dynamic loads produced in a 30 mph crash situation. CRS design considerations are evaluated. The CRS must be compatible with the child's size and anatomical features, which have a great range of variation from birth to six years. These factors have led to the development of CRS in different size categories. The following types of CRS are discussed: rear-facing, supporting the entire body surface; a load distributing surface in front of a forward facing passenger; a fixed surface frontal barrier; and a belt harness system. General criteria for CRS design are presented. It is suggested that available ac-

cident data be examined to determine dynamic performance criteria and test procedures, and to study existing restraint systems. From previous studies it appears that evaluation of a CRS should include: testing at several angles in the frontal quadrants; testing under a variety of conditions which might induce ejection from the seat; the development of a standardized platform simulating the response of a given production seat; revision of testing standards to limit the forward excursion to 25 inches, and the vertical excursion to 29 inches above the car seat cushion; ease of installation and daily use of CRS; and assuring that the system can be marketed at a reasonable price.

by John W. Melvin; Richard L. Stalnaker
University of Michigan, Hwy. Safety Res. Inst.
1975 ; 10p 11refs
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

THE PRACTICAL APPLICATION OF SOCIAL COSTING IN ROAD SAFETY POLICY MAKING.

Examples of British, traffic safety cost/benefit analyses of the following measures are described: the erection of median crash barriers; compulsory usage of seat belts; the prohibition of retreaded tires; compulsory head restraints; countermeasures for underride collisions; compulsory inspection and testing of vehicles; compulsory fitting of new safety tires and wheels; the use of street lighting; road improvements at accident "blackspots"; the use of speed bumps; police enforcement of speed limits; and seat belt publicity campaigns. In addition, the problem of applying a value to the intangible costs associated with injury and death are discussed. The following limitations of cost/benefit analyses are discussed: problems of information (unknown inputs, and uncertainties in data base); conceptual problems (determination of the value of time, amenity, and restraints on freedom); problems of method (frequent disregard of distributional effects on both costs and benefits); and problems of presentation (overselling the technique or presenting it as a form of superior reasoning). It is concluded that cost-benefit analysis is a tool to be used in the service of the political process by which the community reaches decisions on public questions.

by A. Bryan Saunders; David A. Benson
Department of the Environment, Road Safety General Div.
1975 ; 15p 2refs
Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

OPPORTUNITIES TO ENHANCE THE COST EFFECTIVENESS OF SAFETY REGULATIONS

Specific problems resulting from the existing international safety regulations are discussed. An attempt is made to point out some methods of improving the cost effectiveness of motor vehicle safety standards. Efforts to reduce the causes of automobile accidents are the most advanced of all safety efforts being made. It is urged that the role of the individual driver, and of society in general, in traffic safety be brought into a more balanced relation to the role of the automobile in-

self. The following costs are influenced by new automobile standards: information gathering and processing; engineering and development; compliance testing, certification and documentation; production planning, investment for retooling; manufacturing; quality and compliance audit and documentation; operation; maintenance and repair; government surveillance and enforcement; and scrapping. Recommended improvements for safety regulations are: international standardization of safety regulations; legal requirements taking real accident data into consideration; and sufficient time allowed for implementation of standards.

by Hans-Joachim Kraft; Jorg Fellerer
Bayerische Motoren Werk AG, West Germany
1975 ; 10p

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 142

NHTSA'S APPROACH FOR DETERMINING THE CONSUMER COST OF MOTOR VEHICLE PROGRAMS' RULEMAKING PROGRAMS

The efforts of the National Highway Traffic Safety Administration (NHTSA) to determine the consumer costs of Motor Vehicle Programs' rulemaking are discussed. A cost estimation method, including the following procedures, has been established: inhouse estimates by means of a standardized, high-volume, industrial-processing, building-block, cost estimating methodology; dialogue and questionnaires submitted to the automotive industry out of which information and estimates would be provided; and contracting with non-government sources to establish neutral cost estimates, in the event of dispute between the government and manufacturers. A life cycle consumer cost estimating methodology, detailed step guide, and a sample consumer cost estimate, utilizing the building-block method are provided. The advantages of the building-block technique are pointed out. The questionnaires to industry requested voluntary data, or data under statute. The conditions under which NHTSA generally requests cost data from industry under statute are stated and an example of data requests under statute is provided. It is concluded that NHTSA's three-way cost estimating effort generates estimates with supporting backup data that are creditable to the public, congress, industry and court validations, if, for example, NHTSA is challenged as to whether or not motor vehicle programs standards are in the public interest.

by Charles Westphal, Jr.
National Hwy. Traffic Safety Administration, Engineering
Systems Staff
1975 ; 21p 3refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 143

MOTOR VEHICLE SAFETY BELT USE LAWS ON THE NATIONAL AND INTERNATIONAL SCENE

Almost 95% of the cars on United States (U.S.) roads today have seat belts, but only about 30% of the motorists wear them. The extensive efforts made to encourage seat belt usage are described. In view of the low use rates and the failure of

public education campaigns to increase seat belt use, the American Safety Belt Council (ASBC) recommends the passage of seat belt use laws. The National Highway Traffic Safety Administration's (NHTSA) policy of requiring air bags or passive restraints is criticized. The public record of the Department of Transportation's (DOT) appearances before Congressional committees (illustrating its program emphasizing passive restraints) is examined. The effects of mandatory seat belt use laws in Australia are described. Deaths were reported to be reduced by 21.4% and injuries by 35%. It is reported that the laws are not difficult to enforce. Other countries considering belt laws, or implementing them, are pointed out. Efforts made in the U.S. towards a belt use law are described. The following reasons for state inaction on such legislation are presented: lack of direction from the federal government; and the opposition of a minority of citizens who see such a law as an infringement on individual rights. A Gallop poll has shown that the number of people in the U.S. favoring a seat belt use law has climbed from 30% to 53%. Efforts of the seat belt industry to develop more comfortable and convenient belt systems to further encourage belt use are pointed out. To bring about enactment of a belt use law at the state level, and to encourage motorists to voluntarily use safety belts, the ASBC recommends the following to DOT and NHTSA: sponsor a pilot program in one or several states to collect data that would demonstrate the value of such legislation to both state officials and the public; urge Congress to provide highway safety bonus funds to states which enact such laws; and amend existing standards to encourage the rapid development of seat belt systems that are more comfortable and convenient.

by Charles H. Pulley
American Safety Belt Council
1975 ; 16p 24refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 144

MOTOR STANDARDS EFFECT ON INTERNATIONAL TRADE

With the signing of the Treaty of Rome in 1958, the countries of the European Community adopted as their objective the progressive abolition of customs duties, from which naturally follows the removal of non-tariff barriers arising from disparities in rules and standards. The directives provided by this program are described, which set out the requirements governing the various characteristics of motor vehicles and the devices to be fitted on them. Lists of directives adopted, not fully adopted, and proposed are provided, with the aim of giving an overall impression of the European Community's approach. The text of the directive on the type-approval of motor vehicles is provided and the texts of the concluded agreements on the following matters are presented: the mutual recognition of inspections; the stand-still and information agreement; and the Committee on the Adaptation of Directives to Technical Progress. It is concluded that the harmonization of standards for motor vehicles contributes significantly to the free movement of goods and at the same time enables the con-

sumer to have a vehicle which corresponds to safety regulations and rules on the protection of the environment.

by Daniele Verdiani
 Internal Market Commission of the European Communities,
 Brussels, Belgium
 1975; 20p
 Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
 Availability: Reference copy; in HS-801 745

HS-017 145

MODES OF STANDARD SETTING BEHAVIOR: JUDICIAL VERSUS LEGISLATIVE

The administrative standard setting process, as it occurs under the National Traffic and Motor Vehicle Safety Act of 1966, is described and compared with the adjudicatory standard setting process, as it functions in the courts. Distinctions are examined between the processes, as they affect the role of manufacturers in initiating safety design features, and the means available for influencing administrative and judicial decision-makers as to the validity of standards. A historical sketch of legal regulations regarding motor vehicle use and design, leading up to the federal acts of 1966, is presented. The generalized standard setting model that is postulated has the following steps: standard making, review, and consequences. Standard making is the process by which an automobile design feature is arrived at. The nature of the review is the process by which a court is called upon to review the design decision that has been made. Both modes of standard setting behavior are subject to judicial control. Consequences are the sanctions which apply when persons held accountable by the standards fail to conform acceptably. The most common standard of performance in civil law is "negligence." The first consequence of a judgement against a manufacturer is that the manufacturer must pay the damages suffered by the injured person. The 1966 act required conformity to the published standards by all manufacturers, sellers, and distributors of vehicles and equipment, manufactured after the effective date of any standard. Whereas the adjudicatory mode generally leaves the initiation of standards to the discretion of the industry, the administrative mode (the Secretary of Transportation) does not necessarily confer with industry at all. The predictability of the institution of review proceedings in the administrative mode is almost certain, as opposed to the uncertain circumstances of adjudication. Various United States court of appeals cases having to do with the scope of review, which should be given by the courts to the standards, are presented. The courts' authority in reviewing administrative decisions lies somewhere on the spectrum ranging from review of only the decisional processes to a completely new trial of the issues on the merits. The 1966 act provides more control and predictability of consequences (civil penalties) than the adjudicatory standard setting mode. Because the Safety Act gives courts the power to stop sale of a product, manufacturers are not likely to pay the fine and continue to violate the act. The Safety Acts' feedback mechanism is much more solidly coupled into the manufacturer's actual design considerations than is the comparable feedback mechanism in the adjudicatory standard setting mode.

by Joseph W. Little
 University of Florida, Coll. of Law
 1975; 30p 121refs
 Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
 Availability: Reference copy; in HS-801 745

HS-017 146

INTEGRATING VEHICLE SAFETY, COSTS, AND CONSUMER ATTITUDES

The following proposals are made to the federal government: establish a national accident data gathering system to evaluate current and proposed safety standard legislation; utilize data to convince the consumer and industry of the need for the evaluated standards; and to involve the consumer in the standards setting process. A general description of the reasoning behind these three proposals is given. It is recommended that new safety standards be test marketed to determine consumer reaction. An example is given of a survey of 1975 Toronados, Oldsmobile 98's and 88's in which air bags were available. Of the 475 purchasers, only 3% (13) bought the air bag option. The other 97% of the purchasers cited extra cost, apathy, and low confidence and reliability expectations as the primary reasons for refusing it. It was concluded that the maximum future of air bag "optional" installation would be only 23% to 33%, if the air bag option cost \$100. It is clear, in this case, that consumers were not ready to accept air bags. Care is suggested in the passing of safety standard legislation, which might be rejected by the consumer, and thereby nullify the effort.

by Louis C. Lundstrom
 General Motors Corp., Environmental Activities Staff,
 Warren, Mich. 48090
 1975; 12p 5refs
 Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
 Availability: Reference copy; in HS-801 745

HS-017 147

INDIVIDUAL VERSUS COLLECTIVE RESPONSIBILITY FOR SAFETY: AN UNEXAMINED POLICY ISSUE

A thoughtful examination of the assumption of individual responsibility for safety, in terms of its intended and unintended side effects, is urged. Consideration of various strategies to encourage seat belt use suggests that one characteristic of a program, in which individuals take an active role in assuring personal safety, is that the degree of effectiveness depends on the degree of coercion. Various dimensions of active approaches to accident or hazard prevention versus passive approaches are discussed. The individualistic ideology that shifts the burden of responsibility for public problems away from the public to the particular group of people, who are affected by the problem, is discussed. This has affected the approach to the implementation of air bags as safety features in automobiles. Particular attention is given to the Alcohol Safety Action Program (ASAP), which designates the problem drinker as the source of a particular problem, thereby serving the interest of the social drinker. Collective and individual determinants for ASAP's are illustrated and discussed. A study is cited which suggests that ASAP's are not effective in reducing fatality rates. They are built on the ideology of individual responsibility for safety, while the public, the automotive and alcohol industries bear little responsibility. It is suggested that this individualistic ideology has beclouded many important issues.

by Patricia Z. Barry
 University of North Carolina, School of Public Health
 1975; 12p 24refs
 Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
 Availability: Reference copy; in HS-801 745

HS-017 148

FATAL TRACTOR TRAILER CRASHES: CONSIDERATIONS IN SETTING RELEVANT STANDARDS

A series of 150 fatal accidents (19 single vehicle and 131 multi-vehicle) involving tractor-trailers was examined retrospectively. Medical examiner and police reports for 1970-1973 were used. For each multi-vehicle collision, the tractor-trailer and the first vehicle it contacted were studied. Pre-crash, crash, and post-crash vehicle factors are examined to discover characteristics of tractor-trailers that may increase any of the following: the likelihood of crashes; the occurrence or severity of injury to occupants of any of the vehicles involved; or the severity of the consequences. Tractor-trailers were more likely to be the following vehicle in rear end collisions, except for those that occurred on an upgrade. Vehicle failures were noted for 15 tractor-trailers, compared with two of the vehicles they collided with. There were no deaths to tractor-trailer occupants following collision with a car unless, in addition to striking the car, there was another major impact. Underride occurred in 9% of the collisions with cars. Of 41 fatally injured occupants of tractor-trailers, at least eight were ejected and eight trapped in the tractors for prolonged periods. Post-crash fires occurred in 8% of the accidents. The need for adequate braking, improved ability to maintain speed, and weight limits, that do not negate loss reduction benefits achieved under other regulations, is discussed. Other recommendations include improved protection against side and rear underride by cars, and better crash protection for occupants of truck tractors. To discourage present tendencies to sacrifice the safety of truck occupants in the interest of payload, limits for length and weight should be exclusive of the tractor.

by Susan P. Baker; Jackson Wong; William C. Masemore
John Hopkins School of Hygiene and Public Health; Insurance
Inst. for Hwy. Safety; Office of the Chief Medical Examiner
of Maryland

1975; 13p 14refs

Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 149

FACTORS CONTRIBUTING TO THE REDUCTION OF MOTOR VEHICLE FATALITIES IN 1974

Data gathered by the National Safety Council, on the various factors that might account for the reduction of motor vehicle fatalities in 1974, are discussed. The periods studied were: the first four months of 1974, compared with the same months of 1973; and the second four months of 1974, compared with the same period of 1973. Factors such as speed reduction, travel, changes in type of trip, average occupancy, increase in use of seat belts, and changes in age of drivers were assessed, as to their impact on the overall fatality reduction. In both studies, speed reduction (both on high speed and low speed roads) contributed the largest portion of the decrease. Changes in the amount and circumstances of travel also were important, but to a much smaller degree. In both studies, factors were found that increased 1974 fatalities (such as the increased proportion of high-risk, young and old drivers, and the increase in the use

of small cars and bicycles). The influence of these factors had to be offset by the others.

by Vincent L. Tofany
National Safety Council
1975; 8p

Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 150

THE EVALUATION AND IMPROVEMENT OF MOTOR VEHICLE SAFETY THROUGH REGULATION

The nine year period (1966-1975), that motor vehicle safety regulation has been a reality, is briefly examined and discussed in an attempt to determine the effectiveness of the system. The lack of basic data concerned with the effectiveness of the various motor vehicle safety standards, safety defect recall programs, and other subsystems of the regulatory process is pointed out. A general lack of knowledge or misunderstanding about how decisions are made, and who finances motor vehicle safety improvements under this system, further complicates progress. It is suggested that the motor vehicle regulatory system implement the following changes: a priority effort to gather and analyze basic factual data, as a basis for decision making; termination of those standards where a connection between the standard and the prevention of crashes, or reduction of injuries cannot be established; initiation of a "limited access" type of regulatory system, that puts a premium on rational planning, reduction of costs, and improvement of safety; and more balance and coordination between pre-crash, crash, and post-crash program efforts.

by Charles H. Hartman
Motorcycle Safety Foundation
1975; 11p

Presented at the Fourth International Congress on Automotive
Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 151

EVALUATING MOTOR VEHICLE SAFETY PERFORMANCE STANDARDS

Federal motor vehicle safety standards (FMVSS) specifications and industry compliance are compared for the following FMVSS's: no. 105 (split brake systems for hydraulic brakes); No. 109 (tire dimensions and laboratory performance test and identification requirements); No. 202 (requirements for head restraints); No. 203 (requirements for forward-yielding steering columns); No. 205 (requirement for glazing materials used in windshields, windows, and interior partitions); No. 208 (requirements for both "active" and "passive" occupant restraint systems); and No. 209 (requirements for seat belt assemblies). Basic rules for comprehensively evaluating minimum performance safety standards are developed. It is stressed that economic arguments should not be allowed to obscure the basic purpose of the motor vehicle safety standards, which is to reduce accidents and injury. The following stages of evaluation are suggested: statistical comparison, indicating whether or not the performance requirements of the standard are actually reducing the target damage to people and other associated societal damages; more clinical and in-depth measure-

ment of the performance, in reducing the target losses of the various design alternatives chosen by the manufacturers to meet the particular standard; and to determine whether some designs have more payoff than others. An example of a comprehensive evaluation of a safety standard, showing that inappropriate compliant testing can tend to push designs in the wrong direction, is offered, using the case of FMVSS No. 203. Axial-collapse steering columns performed very well in compliance tests, but, in real-world performance, they were shown to be substantially inferior to the self-aligning, energy absorbing, convoluted steel can designs, even though the latter design did not perform as well in the compliance tests.

by Brian O'Neill; Albert B. Kelley; Jackson Wong
Insurance Inst. for Hwy. Safety
1975 ; 10p 42refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 152

EUROPEAN VEHICLE SAFETY STANDARDS AND THEIR EFFECTIVENESS

The administrative structure of motor vehicle safety standards in Europe are reviewed. National standards and directions from the European Commission of the Common Market are compared with the procedures which produce federal motor vehicle safety standards in the United States (U.S.). Main crash protection standards operating in Europe are discussed. Data from a study of some characteristics of static and inertial reel seat belt performance in accidents in Britain are reported. Accidents involved 11, 12, and one o'clock directions of impact, no rear passengers, and no significant intrusion. The following frequencies of contact with the vehicle interior were recorded: of the drivers, 63.6% had head contacts; 28.3% had chest contacts; and 74.5% had lower limb contacts; of the front seat passengers, 38.9% had head contacts; none had chest contacts; and 73.7% had lower limb contacts. A "before and after" study was carried out on three automobile models equipped with non-anti-burst latches. Latch performance by impact type was tabulated. A second sample involving the same vehicle models fitted with anti-burst latches was carried out. A larger sample of latches (297 vehicles with 992 latches) was analyzed, including all the high-volume production designs (Wilmot Breedon "disc latch", Ford fork latch, A.C. Delco Vauxhall latch, and the Chrysler latch). The following general conclusions are presented: the vehicles not fitted with anti-burst door latches showed a performance of 47% normal, 33% opened, and 21% jammed during front impact; a sample with the same variables but fitted with anti-burst locks gave a performance of 62% normal, 16% opened, and 22% jammed; anti-burst door locks resulted in a significant reduction in door opening rates without an increase in jamming rates; the larger sample of anti-burst locks gave a door performance of 68% normal, 7% opened; and 26% jammed; within this last group the consequences of door opening were rated as 1% increased intrusion, 22% no consequence, 16% total ejection of occupant, and 1% partial ejection; and of those latches which did open in the overall anti-burst door latch sample, 76% opened in ways not examined by current latch strength tests. Suggestions for the modification of current latch standards are made. The importance of electrical ignition sources and fuel leakage from filler cap and filler pipe failure, as the sources of automobile fires, is stressed. The benefits of the regulations governing steering wheels and columns, and windshield glazing

in Europe are discussed, showing how changes in one area (seat belts) influence another regulation (glass). Problems of pedestrian protection are also mentioned.

by G. M. Mackay; P. F. Gloyns; H. R. M. Hayes; D. K. Griffiths
University of Birmingham, Accident Res. Unit, Birmingham
B15 2TT, England
1975; 25p 20refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 153

DECISION MAKING CRITERIA FOR RANKING MOTOR VEHICLE SAFETY STANDARDS

The immediate objectives and ultimate goals of national traffic and motor vehicle safety are shown to be derived directly from the intent of Congress, as specified in the National Traffic and Motor Vehicle Safety Act of 1966 and from the overall objectives of the Department of Transportation. The structured hierarchy of goals ranges from the overall serving of public welfare to the specific reduction of accidents and resulting deaths and injuries. The major elements involved in a rulemaking decision are illustrated. They are arranged to indicate the general process of generating necessary data, from its origin to its consideration and comparison with the decision criteria. The influences of goals, constraints, and assumptions upon the process are depicted. The following are the decision criteria which, when compared with impact analyses of the safety standard, indicate whether it would adequately achieve the major ultimate goal: the positive overall contribution to public welfare; the manageable impacts upon other national problems; the significant improvement in safety; the reasonability, practicality and appropriateness for the specified application; acceptable to the public; feasibility within available National Highway Traffic Safety Administration resources; and legally acceptable. The general process that is illustrated can be seen as a direct application of systems analysis techniques to the motor vehicle safety problem and is applicable to a variety of other problems.

by Conrad H. Cooke
National Hwy. Traffic Safety Administration, Motor Vehicle Progs.
1975 ; 8p
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 154

COST-BENEFIT VS. TOTAL BENEFIT IN THE IMPLEMENTATION OF SAFETY STANDARDS

Emphasis is placed on the evaluation of specific traffic safety measures from a total benefit standpoint, in order to establish and implement safety standards. A methodology is presented by which quantified evaluations may be integrated into a total system model, the results of which are useful for total budget allocation. Priorities among safety standards in turn may be structured to promote the maximum total benefit to be obtained for the funds available. The shortcomings of evaluating each measure or standard independently are discussed. An example is given using a spot roadway improvements case history from Alabama. In this case, 157 high risk locations were

considered simultaneously. The investigation results for the first four of these locations (safety measures including roadway signs, delineators, bridge paint, guardrails, redesigned intersections, left turn lane installation and pavement markings) and the set of optimal policies, in terms of budget constraints for the first 20 locations under consideration, are presented. It is found that by comparing all measures simultaneously certain problems inherent in cost-benefit analysis are eliminated, such as the acceptance of projects because they economically pay off. Rather, their relative value with respect to all other proposed investments is taken into consideration. Further examples demonstrating the potential for extending this approach to other types of countermeasures are also given. A pilot project for the allocation of funds in the Alabama Office of Highway and Traffic Safety is used to illustrate both the strengths and weaknesses of this approach. It is estimated that the total benefit technique is an extremely useful tool for bringing into focus more effective budget allocations, and eventually better standards. Qualitative judgement, supported by sensitivity analyses, is still required in areas where data are not yet available.

by David B. Brown

Auburn Univ. Industrial Engineering Dept.; Alabama Office of Hwy. and Traffic Safety
1975; 15p 7refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 155

COST-BENEFIT CONSIDERATIONS IN SAFETY STANDARDS VERSUS ENERGY CONSUMPTION

A general discussion is presented of the benefits derived and the costs incurred as a result of the issuance and implementation of motor vehicle safety standards. Illustrative examples are presented; and the safety and fuel economy impacts of new and proposed standards are estimated. In addition, a general methodological structure for performing cost-benefit analysis is presented. Weight changes in vehicles due to the implementation of successive safety and crashworthiness standards are illustrated. Bumper standards have added about 140 pounds while safety standards have added an additional 120 pounds. Fuel economy penalties have been on the order of 3-4% for the added weight. Comments on the added consumer costs of safety standards made at the Motor Vehicle Safety Standard 105-75 public meeting are presented. An analytical approach to measuring the tradeoff between safety and fuel economy is illustrated. An average increase of 374 pounds was observed for issued standards not in effect and possible future standards. If 374 pounds is taken as the assumed increase, the effects on safety and fuel economy can be estimated. Results show a greater percentage effect on safety than on fuel economy (9% reduction in changes of accident injury with a 2.5% decrease in fuel economy). The general framework for cost-benefit analysis involves the determination and correlation of: the effect on vehicle weight and fuel consumption; the effect on vehicle cost to consumers.

by John G. Rau

Ultrasonics, Inc., Newport Beach, Calif.
1975; 15p 14refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 156

COST-BENEFIT CONSIDERATIONS FOR DETERMINING PRIORITIES IN SAFETY STANDARDS

Volkswagen's revised benefit-cost techniques are discussed. It has shown that benefit-cost considerations are useful tools in establishing a qualitative and quantitative scheme for comparing different possible safety standards. After the safety program objectives and parameters have been defined, the benefit and cost elements to be included are determined, along with their quantitative values and constraints. Cost is defined in terms of cost of purchase, operating cost, maintenance and repair cost. Safety measure benefit is defined as the reduction of accident-caused damage. Four safety measures (a mandatory three-point belt system, passive restraint system, a specially reinforced automobile front structure combined with mandatory active belt system, and the improved front structure combined with a passive restraint system) are graphically represented in a system of coordinates where benefit is plotted against cost. It is concluded that a passive restraint system is advantageous in combination with a reinforced front structure if an amount of \$81 or more is to be incurred. The following methods were used in the revised cost-benefit approach: non-linear optimization computations to compute consistent safety measure combinations, and thus determine consistent test conditions; and a sensitivity analysis to investigate the effect and variances of societal cost figures, frequencies of the various types of accidents, and effectiveness rating assessments. In order to show whether the incorporation of the new safety measure is useful and at what total cost, the following two optimization calculations are performed: an optimized benefit-cost function for roof padding and improved door locks; and the effects of these measures (roof padding and improved door locks) on other safety measures (alcohol interlock system, antilock system, safety distance warning device, and constant beam width control). The societal cost figures for fatalities and injuries derived by Volkswagen and the National Highway Traffic Safety Administration are compared. It is shown that the curve of optimized total benefit is changed considerably by the variation of societal cost figures. The frequency of a certain type of accident significantly affects the benefit produced by a safety measure designed to reduce damage caused by the specific type of accident. The optimization procedure is applied to several sets of varying effectiveness ratings resulting from shifts of cumulative frequency curves of fatalities by accident impact velocity. A comprehensive picture of the results of sensitivity analysis are given. For structural improvement measures consistent test conditions were computed as a function of total cost. The curves of the test velocity for frontal, lateral, and rear impact tests are then plotted versus one another for assumed variations in input data. The graph shows a clearly defined band of consistent test velocities for the vehicle rear and side as a function of frontal impact test velocity.

by Wolfgang Lincke; Werner Langner
Volkswagenwerk AG., West Germany
1975; 24p 4refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 157

CONSIDERATIONS IN DETERMINING PRIORITIES AMONG MOTOR VEHICLE SAFETY STANDARDS

A method is outlined for putting the priority considerations of motor vehicle safety standards into a cost-effective framework, by the following steps: determination of the major safety problems most in need of solutions; review of design types, and engineering and mass production technology, that can be applied to solve the major problems; selection of technology combinations, which can be economically produced and marketed, and are acceptable to consumers; and use of the selected technology as a basis for new standards, which will encourage competition and growth in the auto industry, while providing improvements for consumers. A specific project initiated in 1971 is described. The problem was that small car occupants suffered 30 to 40% higher injury and death rates than occupants in larger cars that weighed from 1,000 to 1,500 pounds more. A survey of consumers' buying habits showed that larger, more crashworthy cars were preferred, but increasing fuel costs were creating a trend toward smaller ones. There was need for an automobile combining light weight, sufficient body crush-deceleration distances, and highly efficient absorption of kinetic energy in collisions, with reduced accident repair costs. Technical solutions to the problems had to be developed outside the automobile industry, as the industry made it clear that it did not intend to develop means of solving them. A 1971 Ford Pinto was converted to provide substantial primary crush zones, without increasing vehicle weight. The energy absorbing system designed incorporates features that can control collision energy from many directions more efficiently than contemporary automobile bodies. The system was shown to absorb 800% more energy than 5 mph "safety" bumpers. Crashworthiness tests and repair costs, based on hundreds of laboratory impact and structural tests, and 40 successful vehicle collision tests, showed no damage at speeds up to 10 mph, and repair costs less than \$400 and repair times less than two hours for impacts at speeds from 15 to 24 mph. Costs analysis shows that average collision repair costs and repair times can be reduced by more than 50%. Frequency of serious and fatal accident injuries can be reduced by 30 to 50%. If 20% of the cars on United States roads incorporate this system, it is estimated that annual national savings will include: 9 billion pounds of petroleum; 2 billion pounds of materials; 9.5 billion kilowatt hours of energy; and \$5 billion in consumer savings. The net cost increase of up to \$150 is projected for a basic stripped sub compact. The effects of the implementation of the new system on consumer organization, the insurance industry, and safety standards are also projected.

by Donald W. Jensen
Vicom International, Inc.
1975 : 9p

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 158

A CODE OF STANDARDS FOR THE AUTO INDUSTRY

The expensive burdens of automobile-related problems (traffic dead and injured urban congestion, air pollution, depletion of oil resources) are discussed. It is urged that firm standards be established reducing passenger vehicle size, weight and power, and mandating steel radial tires, fuel injection, and manual

transmission. The United States needs a good \$3,000 automobile that will last for 20 years, run for 200,000 miles without extensive maintenance, and that will get 40 miles per gallon of gasoline.

by Stanley Hart
Stanley Hart Assoc., Altadena, Calif.
1975 : 6p

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 159

AUTOMOBILE TRANSPORTATION COST TRADEOFFS

The results of cost-benefit studies related to the air quality and accident cost of automobile transportation are presented. Current estimates of the major annual societal costs per automobile in the United States are summarized. Cost categories are: amortized first cost, fuel and highway costs, auto accident, losses, maintenance and garage, parking and tolls, and air quality losses. Average costs and benefits are given for the 1974 to 1975 change in federal Emission Control Standards (ECS) for new cars. New car incremental first costs, fuel consumption incremental costs, and air quality benefits are presented for the present baseline oxidation catalyst ECS and the following alternative ECS's: the California 75 freeze (improved oxidation catalyst system with a lean burn engine and precombusted stratified charge giving hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOX) levels of .9, 9, and 2 grams per mile, respectively); the Statute 77 freeze (advanced oxidation catalyst system with lean burn and oxidation catalyst giving HC, CO, and NOx levels of .4, 3.4, and 2 grams per mile); and the Statute 78 freeze (advanced dual catalyst system giving HC, CO, and NOx levels of .4, 3.4, and .4 grams per mile, respectively). The resulting benefit-cost ratio tradeoffs are given. Benefit-cost data for current lap-shoulder belt and air bag/lap belt restraint system are given. Data from nearly 1.5 million accident-involved cars in the states of New York, North Carolina, Texas, and Washington are analyzed to determine the impact of car size on the risk of fatality or serious injury. The results permit the future effects of small car usage to be projected. The correlation of fatality and serious injury risk to the weight of the vehicle driven and the weight of the vehicle hit are shown. A methodology is developed with an empirical basis to quantify the influence of factors for projecting relative fatality and injury risks for each of the following accident categories: multi-car, and car-truck. A specific small car shift scenario is analyzed in which the sale of subcompact cars rises from 20% in 1974 to 40% in 1980, while large car sale drops from 35% to 10%. The relative fatality and serious injury risk projections (with or without restraints) of all injury categories is shown. In all cases, the risk level in 1985 is lower than in 1974, if mandatory passive restraints are included. If not, a 20% risk increase in 1985 results with the small car shift. Economically, projected fuel consumption benefits are shown to exceed incremental accident losses. The impact of the 55 mph speed limit on accident severity is projected. If the speed limit is strictly enforced, the accident fatality risk is estimated to be reduced by 15%, and the benefit for reduced automobile accident losses

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to be \$30 per annum per person. In addition, a 2.5% average fuel saving is estimated.

by Robert A. Husted
Department of Transportation, Energy and Environment Div.
1975 ; 13p 10refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 160

AUSTRALIAN APPROACH TO MOTOR VEHICLE SAFETY STANDARDS

The relationship between Australian design rules and international standards is examined; future program priorities are discussed; and research needs are highlighted. A cost-effectiveness calculation for putting safety belts in new passenger cars is also presented. Comparative Australian and United States Highway statistics are given. Governmental powers in highway legislation, and methods certification of safety standard compliance are discussed. The legislation requiring compulsory seat belt usage is discussed. Results from a study of the effect of the legislation on usage rates in metropolitan Melbourne and the rural areas of Victoria are presented. Both installation and usage rates increased steadily. Results from similar surveys of both drivers and front seat passengers, on major roads in other cities in Australia, are given. At least 4000 observations were made in each city studied. High usage rates were found throughout these urban areas. The effect of the legislation on vehicle occupant injuries is also considered. Fatalities and injuries for the years 1960 to 1974 are shown, as well as the expected trend and prediction limits for the period 1971 to 1974, based on the assumption that the 1960 to 1970 trend continues. It is demonstrated that the number of registered vehicles, total population, and gasoline consumption have continued on an upward trend. An estimated injury reduction in Australia of 20%, and 39% in Victoria are indicated. Two studies conducted in Victoria in 1971 found that seat belts were not being worn correctly. The results of a sample of 572 drivers are presented. It was also discovered that, under certain dynamic loading conditions, a particular belt buckle design could become disengaged. These findings brought about changes in safety standards. The value is stressed of international cooperation in research, development, and evaluation of improved vehicle safety features and in the standards specifying them.

Australian Dept. of Transport
1975; 35p 12refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 161

THE APPROPRIATE ROLE OF COST-BENEFIT STUDIES IN THE FORMULATION AND EVALUATION OF FEDERAL SAFETY COUNTERMEASURES [MEASURES]

The role of cost-benefit studies in the formulation and evaluation of safety measures is considered. Particular emphasis is given to the dollar equivalent cost of life and injury. Present values of lifetime earnings, according to the Social Security

method of determining such values uses a direct multi-dimensional comparison of the dollar costs, fatalities prevented and injuries reduced without converting the latter two elements to dollar equivalents. Several safety measures found in non-transportation fields are indicated with their associated dollar costs and casualty reduction results, realized or predicted. The basic aim of determining an acceptable level of expenditure for a proposed casualty-reducing program can be met from studying both those programs which have been adopted and those which have been rejected as too expensive. An analytic technique (such as discriminate analysis) can be applied to the costs and benefits (in lives and injuries) of these two groups to suggest a position or range of positions for a decision plane. In this way, a proposed safety standard could be evaluated by comparison with other programs rather than on the basis of a subjective monetary valuation of a life.

by David Morganstein
Center for Auto Safety
1975 ; 14p 7refs
Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 162

AN ANALYSIS OF THE FMVSS-STANDARDS IN RESPECT TO SAFETY OF THE VEHICLE OCCUPANT

A series of investigations, conducted to arrive at an assessment of the benefits produced by safety laws is reported. Particular attention is paid to those aspects that entail passive safety. The difference between the American compliance test, the "self-certification", and the European "type approval" is demonstrated. The costs of making and administering laws and certifications, with corresponding lead-time problems are dealt with. The overall situation following the introduction of European and American safety laws in 1967 and 1968 is considered. The effects of various Federal Motor Vehicle Safety Standards (FMVSS's) are investigated. It is shown that FMVSS 105, 106, 108, 109, 112, and 114 individually produced a total accident reduction of between 4.05 and 10.05%; FMVSS 201, 202, 203, 204, and 205 collectively reduced injuries by 10% and fatalities by 3%; and FMVSS 208, 209, and 210 collectively reduced injuries by 37% and fatalities by 45%. A wearing rate of at least 30% for lap-shoulder belts reduces injuries by 11% and fatalities by 13.5%. The benefit totals produced by all safety standards are shown. A 25% injury and fatality reduction was produced by the 1971 standards. Some examples of FMVSS's are used to show that the present state-of-the-art, in the area of safety measures, has far surpassed the present requirements. A variety of suggestions are made regarding the consideration and implementation of new laws and standards. The situation in regard to international rules and regulations for motor vehicles is reviewed. The institutions and procedures involved are considered. The expense in time and materials of testing is emphasized. It is determined that the "self-certification" procedure in the United States causes substantial, additional cost to vehicle manufacturers, because of the production vehicle survey and component survey, as compared to the vehicle operating certification in Europe. The American consumer is additionally burdened with the indirect cost caused by the financing of the contracts with independent

test institutes for the extensive compliance tests that are required.

by Ulrich W. Seiffert; Wolfgang Rosenau
Volkswagenwerk AG, West Germany
1975; 28p 18refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 163

AN ARRAY OF SOCIAL VALUES FOR USE IN ANALYZING THE NEED FOR SAFETY REGULATION

An underlying reason why motor vehicle safety standards sometimes prove to be publicly unacceptable is that the set of values served by the standard prove not to be dominant in the real situation. Observations of safety decisions and reactions in many situations show a variety of values or concerns applied in judging the safety needs. These concerns complement, or conflict with, each other, and tend to favor or disfavor a proposal. Eighteen forms of such concerns (economic values, public image and psychological motivations, equality and fairness, deservedness of protection, critical position in a technical system, and timing) are arrayed in a schedule to organize a broad evaluation of the need for a safety proposal. Concerns are defined objectively or, if non-objective, are defined narrowly to focus judgement. The resultant array ensures that major concerns are not overlooked by the safety manager. Evaluations of the proposal would be uniformly recorded for review by others and this would disclose a probable pattern for future support or opposition. Proposals could then be adjusted to change either the individual evaluations or the situation in which evaluations were needed. Tactics to broaden support and needs for additional information or opinion research could then be determined.

by Henry H. Wakeland
National Transportation Safety Board, Bureau of Surface
Transportation Safety
1975; 26p 1ref

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 164

THE FEDERAL MOTOR VEHICLE SAFETY STANDARDS: RECOMMENDATIONS FOR INCREASED OCCUPANT SAFETY

The Federal Motor Vehicle Safety Standard (FMVSS) 200 series, developed for occupant injury protection, are reviewed, showing that many of the standards are not achieving their goal. The standards reviewed and their evaluated effectiveness are FMVSS's: 201 (interior impacts, insufficient data available); 202 (head restraints, partially effective); 203-4 (steering control systems, partially effective); 205 (glazing materials, effective); 206 (door locks, partially effective); 207 (seating systems, insufficient data); 208 (passive restraints, insufficient data); 209-210 (seat belt assemblies, insufficient data); 211 (wheel nuts and hub caps, insufficient data); 212 (windshield mounting insufficient data); 213 (child seating systems, insufficient data); 214 (side door strength, conflicting data); 215 (exterior protection, insufficient data); and 216 (roof crush

standard, insufficient data). Findings include: an increase in jammed doors associated with door stiffening devices and modern locks leading to entrapment; child seating systems have been misused, or not used at all because of their cost; more rapid seating systems might increase rather than decrease injuries; and new bumper systems introduced to protect the safety equipment on the car may do more damage to the pedestrian than their predecessors.

by D. F. Huelke; James O'Day
University of Michigan
1975; 19p 46refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.
Availability: Reference copy; in HS-801 745

HS-017 165

FIRE IN MOTOR VEHICLE ACCIDENTS. REV. ED.

The following aspects of the involvement of fire in motor vehicle accidents are examined: the number of such fires that occur annually; the number of fatalities accompanied by such fires; and relationship between types of crashes, fuel leakage, fuel-fed fires, and associated fatalities. The following categories of data are examined: seven previous research studies in this subject area; four separate bodies of Highway Safety Research Institute traffic accident and medical data; and five sets of mortality records maintained by various state or national fire protection or public health organizations. The following conclusions are reached: fires occur in approximately 0.1% of the 17 million motor vehicle accidents annually; 450-650 fatalities resulting from vehicle crash fires occur annually, representing 1 to 1.5% of the 44,800 vehicle occupant fatalities in 1972; fatalities accompanied by fires number 750-1,250 annually, representing 1.7 to 2.8% of the 1972 fatalities; and single-vehicle, severe frontal crashes result in the greatest number of fatalities in accidents accompanied by fire. It is suggested that if all vehicles on U.S. roads were to meet the fuel system integrity tests, specified in the newly amended Federal Motor Vehicle Safety Standard 301, 180-260 (40%) of the annual fatalities resulting from motor vehicle accident fires might be eliminated. This means that if new vehicles complying with the standard are introduced at the rate of 10% per year, this annual fatality reduction might be achieved by 1984.

by Peter Cooley
University of Michigan, Hwy. Safety Res. Inst.
1975; 64p 31refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975. 1974 ed. is HS-015 817 or HS-014 838.
Availability: Reference copy; in HS-801 745

HS-017 166

POLITICAL DETERMINANTS OF FEASIBILITY AMONG SAFETY STANDARDS

The political feasibility of various occupant restraint systems is analyzed. Concepts of policy making theory are applied to major changes in regulations and laws. Feasibility varies among three types of innovations: protective (lap belts, shoulder belts, air bag restraints); convenience (combined three-point belts, inertia reel retracting mechanisms); and behavior modification measures (educational programs, buzzer-light reminder systems, ignition interlock systems, safety belt use laws). Behavior modification measures seem to

be the most readily accepted by decision makers, protective measures next, and convenience measures least. Partisans of the various occupant restraint measures are outlined in the following manner: lap belts and shoulder belts (researchers, physicians, other professionals); air bag restraints (federal government officials, insurance companies, some researchers, public interest groups); combined belts and inertia retractors (researchers); buzzer-light reminder system and interlock system (some auto makers, belt manufacturers); and belt use laws (auto and safety belt manufacturers). The politics of incrementalism is discussed. It is suggested that non-incremental policy proposals, which differ substantially rather than marginally from existing policies, make the outcomes of the policies less predictable. The proposal to convert to entirely passive restraint systems contributed to the adoption, as alternatives, of behavior modification measures; but the resultant conflict endangers both approaches.

1975 ; 19p 47refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 167

SAFETY VERSUS SAVINGS: AN ESSAY ON THE FALLACY OF ECONOMIC COSTS OF ACCIDENTS

The current position held by those designing safety measures is seen to be that we save money by saving lives and injuries. This position has had important consequences but is seen as a fatally flawed one. It is argued that the discarding of this position would lead to more flexible and responsive safety regulation. The assumptions operating in this conversion of death and injury to dollars have no basis in fact. The general move toward quantifying the decision-making process for safety standards is discussed. The implied assumption that our national economy can be treated as the sum of its individual income-earners is attacked. It is concluded that there is no significant, measurable economic loss to our institutionalized, industrialized society resulting from highway deaths. It is pointed out that our domestic economies are dominated by the driver for replacement when a wage-earner dies. The benefits in safety measures are the avoidance of deaths and injuries, of physical and psychological suffering, of dislocation, disfigurement, disfunction, and despair. The valuations that people place on the small quantified changes in the probability of their own death should be used as cost figures for safety measures. The connection between safety and fear and expectations should be accepted so that fuel-fed automobile fires and school bus accidents, for example, might be accepted areas for spending regardless of the cost-benefit considerations.

by Richard B. Dyson

National Hwy. Traffic Safety Administration

1975 ; 10p

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 168

SOCIETAL PRIORITIES IN OCCUPANT CRASH PROTECTION

Accident data and vehicle trends are analyzed, using a benefit-cost model developed by Minicars, Inc., to predict the

societal, economic impacts of various crash injury counter-measure strategies. The following projections for 1975-1985 are illustrated: total passenger car sales; changes in sales by vehicle weight class; auto survival rates; and the total number of cars in operation. Minimum societal costs of injuries and fatalities are estimated and cost accountings presented. Baseline societal losses in 1975 due to occupant casualties were determined and were incremented by factors representing the estimated effectiveness and usage of present occupant restraints, to achieve a true societal loss baseline for unrestrained occupants. Crash mode and intensity losses show that vehicle front and side integrity carry the highest overall priorities, and that both modes contain significant losses at high crash intensity levels. Sources of loss are demonstrated and fatalities, injuries, and societal dollar loss are compared for the frontal mode. Losses are also identified by seating position and vehicle size. The results for certain crash modes and velocity ranges, rank-ordered by societal injury loss, are presented for the 1978 model year. The efficiency of active, passive, and active/passive restraints in traditional passenger car structures was established, and effectiveness for injury and cost reduction was estimated for each crash mode as a function of crash intensity. Estimates of passive restraints effectiveness are given based primarily on a mode-by-mode analysis of the overall crash picture to effect a comparison between belt and airbag restraints. Previous studies indicated that lap belt, lap/shoulder belt use will be about 26% in 1975 model cars. The readiness of air-cushion restraint systems is discussed. It is pointed out that General Motors' passive restraint system would have 7,000 times fewer failures than active restraints. Occupant restraint systems are outlined and compared by retail price, total operating cost, and total lifetime cost for shoulder-lap belts, air cushions, and air cushions with lap belts in six and four passenger cars. Various economic factors suggest that neither the consumer nor the manufacturer would be mistreated by the air cushion system. The economic patterns of lap/shoulder belts and air cushion/lap belts for the 1978 model year are compared and subdivided by vehicle class. The predicted fatality reductions from 1975 to 1985 resulting from the various restraint implementations are exhibited. The predicted costs and savings of the implementations are detailed. Estimated implementation profiles for mandatory restraint use laws in the United States (1975-1985) are given. The implementation of passive restraints in 1977 is compared with mandatory use legislation using a benefit-cost model. Delay of introduction of full front seat passive air cushion/lap belt restraints from 1978 to 1981 is projected to result in 37,600 needless deaths from 1975 to 1985. A three-year investment of \$1.4 billion per year for implementation of passive air cushion restraints is projected to produce a \$18.6 billion return (350%) on investment.

by Charles Y. Warner; Michael R. Withers; Richard Peterson Brigham Young Univ., Provo, Utah 84602; John Z. DeLorean Corp., Bloomfield Hills, Mich. 48013; Minicars, Inc., Goleta, Calif. 93017

1975 ; 55p 36refs

Presented at the Fourth International Congress on Automotive Safety, San Francisco, 14-16 Jul 1975.

Availability: Reference copy; in HS-801 745

HS-017 170

TRAFFIC CONTROL DEVICES HANDBOOK. AN OPERATING GUIDE

Typical values or ranges of values used for implementing traffic control measures are presented and examples are provided

of specifications, contract plan sheets, and work orders. Signs, pavement markings, and signals are discussed in detail. Traffic control signs are considered in terms of the following: supply sources, materials, fabrication, personnel and equipment, installation and maintenance, inspection criteria, vandalism, and records. The following aspects of road pavement markings are discussed: materials (including specifications, drying time, bead types, application rates, plastic marking materials, and temporary markings); methods of application (including truck-mounted stripers, and small portable striping units); application operations (including instructions for painting traffic lines, removal of markings, records, establishing no-passing zones, and field procedure for locating zones); and other means of pavement markings (use of raised markers and delineators). Discussion of traffic control signals covers the following: basic types of control (pre-timed signal operation, traffic actuated control, and comparison of the two); signal design and operation (time cycle, manual control, signal design plans, and accident experience at traffic signals); signal systems (types and applications, conditions affecting efficiency of pre-timed signal systems, speeds for progressive systems, types and selection of coordination, degree of flexibility of intersection controllers, coordination of traffic actuated signals, and traffic signal system timing plans); special types of traffic signals (flashing beacons, pedestrian signal indications, one-way restricted zone control, emergency traffic control signals, traffic signals at and near railway grade crossings, lane use control signals, and pre-signals and speed funnels with examples); traffic signal equipment (detector types and installation, signal optical unit, and visibility control); and installation and maintenance of signals in general. A glossary of terms is provided after each main section.

National Advisory Comm. on Uniform Traffic Control Devices, Washington, D.C. 20590
1974; 199p refs
Availability: Corporate author

HS-017 171

THE FINANCIAL CONSEQUENCES OF AUTO ACCIDENTS

The results of a random survey of 34 accident victims (accidents occurred in Washtenaw County, Michigan, from April 1, 1972 to April 1, 1973, and involved American cars three years old or less) indicate that there is a wide difference in costs to accident victims with injuries in different Abbreviated Injury Scale (AIS) severities. In the lower severity categories, the costs are skewed and show a considerable variation. Most are associated with the property damage in the accident; the ambulance and emergency room examination are the only medical costs for the majority of the AIS-1 injuries. As the severity increases, the major portion of the cost of the accident shifts from the property damage to the medical costs and lost wages. For injuries in the AIS-3 category, medical costs and lost wages are roughly equal, with property damage still a significant cost associated with the injury. Since, in this study, there was a one-to-two year time lag between the accident and the follow-up interview, there was great difficulty in locating victims. It is suggested that in future studies, initial collection of data concerning costs be instituted as soon as possible. The most useful information was obtained in personal interviews, followed by telephone interviews. The results of the survey were limited by geographical area, non-response rate, and small sample sizes; hence, the estimated costs per injury were substantially below those estimated by other

sources. The estimates used by the National Highway Traffic Safety Administration corresponds reasonably well with the cost estimated in the study for AIS-3 severity. Injuries of this severity constituted only about 3% of all non-fatal injuries, and injuries more severe than AIS-3 constituted less than an additional 1%

by Jairus D. Flora; Judith Bailey; James O'Day
Publ: HIT Lab Reports v5 n10 p1-7 (Jun 1975)
1975; 10p 2refs
Availability: See publication

HS-017 172

DRIVER EXPECTANCY AND PERFORMANCE IN LOCATING AUTOMOTIVE [AND ACCESSORIES] CONTROLS

Research was undertaken to provide information to the Society of Automotive Engineers Subcommittee which could be used to develop a recommended practice or convention for the location of certain hand-operated controls in foreign and domestic passenger cars, light trucks, and multi-purpose vehicles, in order to facilitate the driver's task of finding and identifying the controls in unfamiliar vehicles. The first phase, problem analysis, was accomplished through two field surveys to test the kind of control-locating problems that motorists usually encounter in their own, and rental vehicles. The second phase was a series of methodological studies to develop and evaluate the experimental techniques which could be applied to the program. The third phase was a major survey of driver expectancy for automotive control locations. The final phase was a major experimental study of control-locating performance that was designed to measure the effects on driver performance of the discrepancy between the actual locations of automotive controls and control location expectations. A total of 3,528 drivers participated in the survey, and 2,152 drivers served as experimental test subjects. During the course of the survey and tests, a quarter-million driver responses were recorded and analyzed. The following recommendations for control location standards were found, based solely on the factors that influence the speed and accuracy with which automobile drivers can locate and identify controls: the headlight switch and wiper/washer control unit should both be located on the left panel, preferably with the headlight switch above or outboard of the wiper/washer control switch; radio and climate control units should be located on the right panel; the cigarette lighter and ashtray should be located within a zone that may include the lower part of the right panel, the edge of the panel, or the upper part of the console, but the lighter should be in full view, and not inside the ashtray; an international agreement should be sought to standardize the location of the hazard flasher with its location either on the instrument panel or the steering column; and the vent control should be integrated with the functions contained with the climate control unit.

by James J. McGrath
Anacapa Sciences, Inc., 2034 De la Vina St., Santa Barbara, Calif. 93105
Rept. No. VRI-RR-14.1; 1975; 179p 4refs
Availability: SAE

HS-017 173

**CONTRAST REQUIREMENTS OF URBAN DRIVERS
[VISIBILITY]. INTERIM REPORT, PHASE 1**

The development of a technique for the quantification and specification of the visibility needs for urban drivers is documented. The predictive strengths of various lighting concepts and formulations are assessed and the most suitable technique for visibility quantification in an actual roadway environment is identified. Field experiments were used to evaluate the various lighting techniques in use today. A test site six lanes wide and about 1800 feet long was used. The test site lighting system, utilizing 16 pairs of independently controllable standard 400-watt mercury vapor luminaires, provided a systematic means of varying street illumination parameters, such as horizontal and vertical illumination levels, and illumination uniformity. Luminaires were spaced an average of 110 feet 6 inches apart. The target used was the bottom 18 inches of a standard traffic cone painted to be 6% reflectant, which were spaced at 50 foot intervals in the center of the middle south bound lane. Horizontal and vertical illumination levels, target luminance, background luminance, and glare luminance were measured. A system of 25 eight-foot tapeswitches were installed and the overall system was controlled from a van. Driver reaction (brake or lane change) to the system was noted. The factors involved in visibility measures and contrast measurements are discussed. Within the range of variables studied, pure contrast represented the most important element in determining visibility. Contrast was found to have the greatest correlation with driver performance. Other conclusions were that: the influence of glare is largely undifferentiated under the lighting conditions tested; spot background luminance is a good predictor of adaptation level given the luminance variability reported; the visibility index proved to be the most reasonable predictor of driver performance, suggesting that in more variable situations this measure is recommended; and the equivalent contrast term seems relatively sensitive to subjective factors causing this value to be highly variable.

by V. P. Gallagher; P. G. Meguire
Franklin Inst. Res. Labs., Benjamin Franklin Pkwy.,
Philadelphia, Pa.
Contract FH-11-8037
Rept. No. FHWA-RD-74-76; FIRL-I-C3660. ; 1974 ; 81p 6refs
Availability: NTIS

HS-017 175

**EVALUATION OF REGIONAL ECONOMIC AND
ENVIRONMENTAL EFFECTS OF ALTERNATIVE
HIGHWAY SYSTEMS. FINAL REPORT**

A multiregional, multi-industry forecasting model for evaluating alternative highway systems is described. The driving force in the forecasting model is a set of equations that explain industry location by the relative prices that industry faces at each location. Important among these prices is the transportation costs that are incurred in shipping the goods either into or out of a region. After industry output is forecast, other variables are derived, including employment, income, population, consumption, investment, and government expenditures. Highway systems affect forecasts in three principal ways: improved highways decrease the transportation costs of shipping goods and thus influence the location of industry; improved highways reduce the congestion within a region, particularly in metropolitan areas; and the construction of highways stimulates employment and income. Economic and demographic

characteristics are projected to 1990 for each of the 173 functional economic metropolitan areas (as defined by the Bureau of Economic Analysis) that comprise the United States. Separate projections are made for each of five hypothetical assumed alternative highway systems. The alternatives are: the base year system which assumes that work on the Interstate highway system stopped in 1970; the completed Interstate System which assumes that the present Interstate highway system will be completed by 1976; the Extended Primary system which extends the Interstate system to incorporate smaller cities into the intercity network; the Economic Development system, which is designed to serve areas with low incomes; and the Urban system, which is designed to lower traffic congestion in Urban areas. These last three systems are hypothetical alternatives scheduled for construction between 1976 - 1986. The redistributive impact of the hypothetical alternatives results in some substantial variations in regional population growth. For example, the 1990 population of one low population area would be 22 percent higher under the completed Interstate than with the base year alternative, whereas in another area it would be 10 percent lower. In one large population area, population would be 3 percent higher with the Urban system than it would be with the completed Interstate system, whereas in another smaller area it would be 6 percent lower. An appendix supplies tables that give 1970 and 1990 resource requirements by user section and pollution emissions by polluting sector for the aforementioned selected economic areas and highway alternatives. After completion of the major study, two additional tasks were added, which tested the accuracy of the forecasting to 1970 from 1966 and comparing the 1970 forecasts with actual 1970 data. The tasks also ran the forecasting model under an alternative which assumes that all truck shipments over a certain number of miles went "piggyback"; and added a resource-use coefficient and pollution emission coefficient for the purpose of determining regional resource requirements and environmental damage associated with alternative highway systems. Tables provided show the measurement of accuracy of the forecasting model; the rail, motor, and piggyback cost of shipping between New York City and Washington, D.C.; the population projections for 1990 by census region, population size group, and economic area, under the six alternative transportation networks; and the per capita income projections for 1990, by per capita income size group and economic area under the six alternative transportation networks.

Curtis C. Harris Assoc., Inc., 7008 Wells Pkwy., Hyattsville,
Md. 20782
Contract FH-11-7766
1974 ; 437p refs
Availability: NTIS

HS-017 176

**ENERGY CONDITIONS IN FRONTAL COLLISIONS
OF AUTOBUSES [BUSES] (ENERGIAVISZONYOK
AUTOBUSZOK HOMLOKUTKOZESENEL)**

Statistics on the relative frequency of frontal collisions of buses were projected into statistical data on trucks and passenger vehicles. The requirements applicable to buses in frontal collisions are applied, namely: that the environment (other vehicles, pedestrians) should not be endangered beyond a minimal extent; the physical safety of passengers in the vehicle should be maximally protected; and there should be a reduction of physical and financial damage caused for the bus by the collision. These requirements are also given in numeri-

cal terms, on the basis of analyses of the quantities of energy absorbed by the shock absorbing system at the time of the occurrence. Eventually, a shock absorbing system with a factor for frontal collisions was devised. Findings are described which resulted from frontal collision experiments conducted with an IK 250 bus in terms of maximal reduction of velocity, residual deformation, degree of recoil from a beton wall, and duration of the collision. Finally, an account is rendered of laboratory examinations of loss of stability and energy absorption capability of thin-walled tubes. Connections between the speed of the collision, the maximal slowdown during its course, and the degree of the capability of the tubes to absorb energies are defined by equations.

by Mathias Matolcsy; Csaba Molnar
1974 ; 53p 16refs
Text also in Hungarian.
Availability: Reference copy only

HS-017 177

A METHOD FOR ASSESSING THE IMPACT OF THE ENERGY CRISIS ON HIGHWAY ACCIDENTS IN TEXAS

An attempt was made to determine a correlation between the imposition of the 55 mph speed limit and resultant accident reduction (in the state of Texas). Initially, information currently available from various state agencies which normally record periodic accident data and travel behavior was determined. The study procedure was to develop a before-and-after array of statistics centered around the change in the legal speed limit. The change in accident severity by types of accidents occurring on specific classes of highways was investigated. A regression model was developed to forecast both fatal and injury accidents on a weekly basis, with a separate analysis for weekdays and weekends. Traffic accident data from 1972 and 1973, modeled by a Poisson process and analyzed by computer, were used to forecast the expected number in the categories of weekly accidents for 1974. Once the actual 1974 accident experience is released, comparison with the Texas forecasts can be made. The methodology, not only provides the appropriate modifications of regression analysis techniques that should be made when accident data are being considered, but also a basis for evaluating the significance of the deviations from the forecast values for 1974. A more detailed disaggregate evaluation is recommended to dispel uncertainties concerning the 55 mph speed limit and accident experience.

by E. L. Frome; C. M. Walton
Council for Advanced Transportation Studies, Univ. of Texas, Austin, Tex. 78712
Rept. No. DOT-OS-30093; RM-12 ; 1975 ; 25p 4rcfs
Availability: Corporate author

HS-017 178

INJURY PATTERNS IN MOTORCYCLE COLLISIONS

Motorcycle injuries in Sacramento County, California, during 1970 are described and certain factors associated with their occurrence are examined. Specific findings concerning the nature and severity of trauma associated with motorcycle collisions are emphasized. Two separate groups of injuries, serious and minor, were defined. Serious injuries included those resulting in death, hospitalization, a medically diagnosed fracture

(excluding small chip and avulsion fractures, and fractures of fingers and toes), or medical care beyond two visits to the physician. Minor injuries included superficial lacerations, abrasions, bruises, chip and avulsion fractures, or fractures of fingers and toes, which required treatment by a physician. Accident records and medical admission records were utilized. A random sample of 738 non-injured motorcyclists obtained from a list of registered owners was used to ascertain differences between injured motorcyclists and a comparison group with respect to certain driver and machine characteristics. To obtain information not available from police accident reports, a questionnaire was mailed to all surviving injured motorcyclists and members of the comparison group. A total of 1,273 injured motorcyclists were identified. The following factors involved in these injury-causing accidents are discussed: incidence; type of collision; hospitalization and disabilities; location and type of injury; pattern of serious injury in the head, trunk, and extremities; fractures of the leg; bilateral fractures; thoracic and abdominal injuries; multiple injuries; severity of injury; and characteristics of fatally injured motorcyclists. The annual injury incidence was found to be 2 per 1,000 population, with peak incidence injury rate for male operators 18 years of age. Slightly more than 4% of all registered motorcyclists were involved in an injury-producing collision in a single year. Almost 45% of injured motorcyclists suffered a serious injury, with injuries to the musculoskeletal system in the form of fractures, being the most common. The average length of hospitalization was 12 days, and 75% of those injured indicated one or more days of disability. The incidence of multiple fractures and other injuries was also high.

by Walter F. Drysdale; Jess F. Kraus; Charles E. Franti;
Richard S. Riggins
Publ: Journal of Trauma v15 n2 p99-115 (Feb 1975)
1975 ; 22rcfs

Supported in part by the Insurance Inst. for Hwy. Safety and the Univ. of California (Davis), Dept. of Community Health. Availability: See publication; Jess F. Kraus, Univ. of California at Davis, School of Medicine, Dept. of Community Health, Davis, Calif. 95616

HS-017 179

RECOMMENDED MODIFICATION OF SUPERELEVATION PRACTICE FOR LONG-RADIUS CURVES

The findings are presented of a project initiated to deal with those accidents involving skidding on highway sections combining horizontal curvature with vertical grade. Guidelines for highway geometrics and pavement surface characteristics were developed to ensure adequate vehicle control during anticipated maneuvers on such sections of highways. Based on the combined findings from an extensive analysis of accident data, computer simulation studies, and an in-depth field investigation of two high-accident sites, (Pennsylvania Turnpike, 9822 accidents over 2 1/2 years, and the Ohio Turnpike, 5553 over 4 1/2 years), the researchers concluded that drivers are not likely to lose control of their vehicles on curve-grade sites unless they are attempting to perform severe maneuvers on slippery road surfaces with fair to poor tires. Findings are reported for the following major tasks of the project: an accident data analysis of the Ohio and Pennsylvania Turnpikes (The Pennsylvania Turnpike accident rate was not dependent on grade but increased with the degree of curvature; while for the Ohio Turnpike, the accident rate was independent of all but the steepest downgrades, however, accidents at curves of 1° were nearly twice the overall rate and were especially

prevalent on wet pavements.); a computer simulation analysis using small and intermediate sedans and a station wagon through various maneuvers (The curvature had a large influence on the safe speed for normal cornering, but little influence on skid resistance, yet during passing or braking, pavement skid resistance became the primary factor influencing the maximum initial safe speed from which lane change and braking could be performed.); pavement drainage analysis (Increased road width led to increased water depth; increasing the cross slope led to lower water depths; and the result of increased grade was essentially zero.); and field site investigations (two sections of highway with high accident rates were subjected to in-depth evaluation to determine accident causation factors). Both field sites were 1° curves on a downgrade of about 2% to 3% with cross slopes of 0.0156 feet/foot. The major problem with both high-accident sites was found to be inadequate tire-pavement friction during wet weather. Other topics discussed are: recommended standards for highway curves and grades; highway agency superlevation practices (lacking conformity); the necessity for reducing driver demand (severe maneuvers); and remedial measures for existing high-accident sites.

by D.F. Dunlap; P. S. Fancher; R. E. Scott; C. C. MacAdam; L. Segel
Publ: Research Results Digest h72 (May 1975)
1975 ; 10p 2reft

A staff digest of the essential findings from the final rept. on National Cooperative Hwy. Res. Proj. 1-14, "Influence of Combined Highway Grade and Horizontal Alignment on Skidding".
Availability: TRB

HS-017 180

THE EFFECT OF EXHAUST RECYCLE ON KNOCK-LIMITED SI [SPARK IGNITION] ENGINE PERFORMANCE

Some recent work performed to establish the effectiveness of exhaust gas recycle as a knock suppressant in spark ignition engines, and to determine the effect of fuel and engine operating conditions on knock-limited engine performance and nitric oxide emissions is reported. Performance was evaluated with two different fuels: American Society for Testing and Materials (ASTM) isooctane and ASTM 80 octane. The experimental apparatus was a cooperative fuels research single cylinder, variable compression ratio engine coupled to a Dynamic Model 66 D.G. eddy current absorption dynamometer fitted with recycle apparatus. The dynamometer control system maintained a constant engine speed of 850 plus or minus 10 rpm during all runs. With ASTM 80 octane fuel, operating near stoichiometric, the higher knock-limited compression ratio (K.L.C.R.) resulted in a break mean effective pressure which was constant for moderate recycle, falling only with high recycle rates. Brake specific fuel consumption (BSFC) decreased with recycle to a minimum, and then increased for higher recycle rates. For lean mixtures, however, BSFC increased steadily with recycle. Performance was similar with the isooctane. The performance recovery for stoichiometric and rich mixtures (low to moderate recycle) was attributed to the higher K.L.C.R. and changes in the specific heat ratio. The observed degradation in performance recovery for lean mixtures

and high recycle rates was due to losses associated with the lower burning rates.

by James L. Hodges
Rensselaer Polytechnic Inst.
Grant NSF-GK-326170
Rept. No. SAE-750025 ; 1975 ; 8p 14reft
Presented at the Automotive Engineering Congress and Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 181

BORG-WARNER AUTOMATIC TRANSMISSIONS MODEL 45 AND MODEL 55

Borg-Warner M45 (four-speed) and M55 (three-speed) automatic transmissions for passenger cars is discussed. A design was needed which would allow for the production of automatic transmissions in which the majority of components, other than gears, could be produced on a transfer press. In this case, the press was a Wilkenson-Mitchell type press of the 1000 ton capacity. The beds for the press can accommodate nine stations at a twelve inch pitch with a maximum speed of twenty-five strokes per minute. Requirements for the transmission design were: it must be capable of shifting at 6000-7000 rpm; the overall envelope must be as small as possible; the amount of material used must be compatible with the torque level selected; manufacturing methods must be both economical and flexible; and eventual development of the transmission capability must be 10,000 rpm. It was decided to use precision stampings for all of the major components within the transmission, which necessitated using some type of joining technique. This was accomplished by use of an electron-beam method of welding. The three-speed geartrain arrangement is a Simpson type gearset with one-way clutch elements in both first and second gears, so that all shifts in the automatic range are made by lifting or dropping back to the free-wheeling elements. All of the friction elements are one size. The gearset of the four-speed transmission also consists of a Simpson type planetary arrangement with the addition of another simple gearset behind the Simpson to give the first-speed and reverse ratios. Pressed components for the two transmissions can be divided into hubs, flanges, connecting pieces, planetary carriers, and clutch drums. All of the parts are produced from strip stock of SAE 1008-1010 material. No special treatment of the steel is required other than it be of good commercial quality. The amount of detail produced on the piece is limited by the number of stations available of the transfer die. From the standpoint of economy of material and labor it should be noted that: scrap loss is not negligible; secondary operations to produce features not possible on the transfer presses are usually difficult due to the tough nature of the basic strip; accurate features can be produced well within automatic transmission requirements, and tend to remain stable; joining operations by welding or simple mechanical joints are simpler than with cast components, but they are expensive; parts can be heat treated to provide surface conditions which are superior to those of the basic strip, but distortion is a major problem.

by John S. Ivey
Borg-Warner Corp.
Rept. No. SAE-750084 ; 1975 ; 12p
Presented at the Automotive Engineering Congress and Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

INSTRUMENTAL PRACTICE IN THE CVS METHOD OF EXHAUST EMISSION MEASUREMENT

Reliable measurement of exhaust emissions is dependent upon acquiring unperturbed samples that accurately represent the composite of material discharged during the interval for which the measurement is made. The constant volume sampling (CVS) method has gained general acceptance because it maintains high sample integrity, and volumetric control, and measurement is relatively less complicated and lends itself to direct mass measurement. CVS procedures involve measurement of carbon monoxide and carbon dioxide by nondispersive infrared; the measurement of unburned hydrocarbon by flame ionization detection; and measurement of combined nitric oxide and nitrogen dioxide by the principle of chemiluminescence. Interviews with daily users of CVS systems revealed the following critical items or problem areas in CVS measurements: operators of the test equipment should be provided with suitable guidance and reference materials pertaining to the operation of CVS equipment; flow rates of hydrocarbons and chemiluminescence analyzers must be precisely controlled at all times since temperature variations and changes in composition of the gas can affect absolute gas flow rates; effects of pressure fluctuations downstream of a nondispersive infrared instrument's sample outlet should be understood and the potential for interaction protected against; the use of optical filters for low level CVS measurement of carbon monoxide is essential; sample streams to all instruments must be free of particulate and aerosol in any form, which can be accomplished through the use of an ice trap to lower the dew point of the sample; and operations which involve large numbers of CVS emissions measurements can find a higher effectiveness in operational procedures when the instruments are calibrated and aligned by an independent group. This insures a greater objectivity.

by R. W. Hurn
Energy Res. and Devel. Administration, Bartlesville Energy Res. Center, Bartlesville, Oklahoma
Rept. No. SAE-750679 : 1975 : 11p 2refts
Presented at the Fuels and Lubricants Meeting, Houston, Texas, 3-5 Jun 1975.
Availability: SAE

A REVIEW OF ANTI-SKID BRAKING

The rate of deceleration for a rotating wheel is measured in terms of slip, a factor relative to the vehicle's forward speed. Maximum tractive force between the tire and the road is obtained at slip values from 10-20%, maintained constantly as the vehicle slows down. Anti-skid braking was designed to maintain the desired slip average automatically. This is done by quick brake applications above and below the optimum setting, causing the brakes to pump in cycles, sometimes as rapid as four per second on dry concrete. This rapid pumping would only take place during a braking situation causing a skid, or a deceleration of approximately 26-28 ft per second per second. The speed of the wheels can be sensed by a two-wheel or four-wheel (rear wheel sensing) system. Or individual wheel speed sensors can be mounted at the wheel hubs or on the drive shaft to supply an average signal. Development programs reveal that it is possible to design a module with a performance down to 0.1 coefficient of friction. Performance test-

concrete in a comparatively short distance with a maximum of noise and smoke and the wheels locking; a general improvement on snow and ice surfaces over conventional braking; and, on gravel roads, it was found that the shortest stopping distance was obtained by hitting the brakes hard, locking all four wheels, and plowing a deep groove in the road. There is no steering control, but stopping distance is quite short.

Publ: Automotive Engineering v83 n7 p34-8, 57 (Jul 1975)
1975; 3refts

Based on SAE papers SAE-690213, "Evolution of Sure-Track Brake System," by R. H. Madison and Hugh E. Riordan; SAE-710248, "The Chrysler 'Sure-Brake'--The First Production Four-Wheel Anti-Skid System," by J. W. Douglas and T. C. Schaefer; and SAE-741083, "Wheel Lock Control Braking System," by Robert A. Grimm.
Availability: See publication

SELECTING MATERIALS IN AN ERA OF CHANGING REQUIREMENTS

Materials selection priorities in the automotive industry are presently in a state of flux. Selection of a material and fabrication method becomes even more complex when viewed from the standpoint of Federal and State regulations governing the amount of energy allowed to produce products. Even though material A is lighter than material B, if it uses a lot of energy in production, the choice will not be easy. The practice of producing components in-house or by an outside supplier also adds to the cost problem. Nevertheless, some trends can be seen. Projections for the use of plastic in cars shows a growth from an average of 85.5 lb of plastic in 1974 to 160 lb for an average 1975 car. Almost all plastics can be reinforced or filled to add strength, bulk or engineering property to the material. At present plastics are used as follows: grilles and instrument panels made of ABS (Acrylonitrile-Butadiene-Styrene), 15 lbs on the average; PVC (Polyvinyl Chloride), about 30 lb used for roof tops, floor mats, instrument panel covers and seat covers; Polyethylene, about 6 lb for wiring insulation and fender liners; Polyurethane, about 35 lb for auto seats, and a projection of 50 lb or more if used for front and rear end crash absorption; Polyester for lamp housings and valence panels, about 10 lb; Polypropylene, about 22 lb, for use in battery cases, heating housing, headlamp housings and decorative grilles; and Polyamides, about 6 lb, used for gears, radiator fans and canisters. Aluminum has been in use for auto bodies and engines since 1900, and today's car averages about 84 lb of aluminum per car. However, it is projected that that amount may rise to about 200 lb per car by 1980. Steel still accounts for the bulk of materials used in autos, and although the amount used in each car will be reduced as vehicles become smaller, the percentage of steel used probably will not change appreciably. In the final analysis, cost, weight, and availability remain as key materials selection parameters.

by Robert J. Fabian
Publ: Automotive Engineering v83 n7 p23-7 (Jul 1975)
1975
Availability: See publication

HS-017 185

AN EXAMINATION OF THE EFFECTS OF THE 55 MPH SPEED LIMIT ON NORTH CAROLINA ACCIDENTS

Due to the energy crisis of 1974, and resulting measures to reduce fuel consumption, such as the lowering of the speed limit to 55 miles per hour, there were dramatic changes in the highway transportation system. Data on North Carolina's vehicle speeds, accident frequency and severity, and traffic counts provide insight into the causes of the reduction of highway accidents and casualties. Emphasis is placed on the effects of the 55 mph speed limit through comparative analyses of 1973 and 1974 data, using various parametric and non-parametric statistical tests. The following findings were indicated: following the imposition of the lower speed limit, all sampled roadways experienced initial decreases in various measures of central tendency of speeds, however, the initial decreases were fully recovered by November 1974; and speed variation, as measured by the percentage of vehicles traveling in the 10 mph pace, decreased for all roadways, with the decreases becoming more pronounced as time went on. Accident rates changed too. Total 1974 accidents were 3.7% lower than the 1973 accidents, with fatal accidents decreasing 11.2%. While both traffic accident damage severity and estimated speed prior to accident decreased, the driver injury distribution did not change significantly on Interstates. Changes in traffic counts were as follows: traffic counts for 1974 were lower than for 1973 for all roadway classes; and when proportional changes in accidents were compared to proportional changes in counts and predicted changes based on past research, accidents appeared to have decreased significantly. These findings indicate that while the direct severity reducing effect of the 55 mph limit may have disappeared after November 1974, indirect effects on speed variances and changes in driver attitudes may have continued.

by Forrest M. Council; Linda Pitts; Michael Sadof; Olin K. Dart
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill N.C.
1975 ; 105p 20refs
Supported by the North Carolina Governor's Hwy. Safety
Prog.
Availability: Corporate author

HS-017 186

NEW MATERIALS PROMISE SAFER TIRES

The biggest problem in tire research and construction today is wet traction. The second is road hazards such as glass, metal bits and nails. Two new materials may delay the failure of tires even more. They are silicic acid as a tread-compound ingredient; and Kevlar as a belt material to slow down cut growth and tire failure. Silicic acid contains silicon di-oxide, a hard, insoluble mineral with a high melting point such as is found in flint, quartz and silicates in rocks and ores. On wet pavement, the silica particles interact with unevenness in the road surface. The colloidal dispersal of the silica in the basic rubber compound creates a gel-like characteristic, known as thixotropy. It creates a freer molecular movement in the boundary layer of the tread; prevents stiffening of tires in low temperatures; and remains elastic to 40 below. Problems, however, come from a high rolling resistance (resulting in high energy loss), and rapid wear on abrasive road surfaces. Kevlar is used as a belt-material for both radials and bias-ply tires.

It's an aramid, or a manufactured fiber made of a long-chain synthetic aromatic polyamide, in which at least 85 percent of the amide linkages are attached directly to two aromatic rings. Kevlar's strength is so great that a half a pound of Kevlar can replace 2 1/2 pounds of steel. In addition, it is predictable, doesn't pick up moisture, and will not burn or melt. Kevlar-belted tires fail later than steel-belted tires after severing similar cuts, and have about 50 percent more miles left in them. Strength in cord materials is also under study. Rivaling rayon for the lead as a cord material is polyester. Polyester is more expensive than rayon, but it is stronger, and keeps the tire running cooler. Short term developments in the tire industry (over the next 12 years) are concerned with eliminating the spare wheel and simplifying tire maintenance. In the long term, it is hoped to produce a tire with a run-flat capability, and a one-piece wheel/tire combination.

by Jan P. Norbye
Publ: Popular Science v207 n2 p62-4 (Aug 1975)
1975
Availability: See publication

HS-017 187

MOTOR CARRIER ACCIDENT INVESTIGATION. GENERAL INDUSTRIES, INC. ACCIDENT--JUNE 27, 1974--CHARLES TOWN, WEST VIRGINIA

An accident involving a tractor flatbed trailer combination and a Volkswagen is reported. The road--West Virginia State Route 9--consists of two 12 foot blacktop lanes and contains sharp curves leading down a mountainside. Advisory traffic warning signs are mounted, on the same post, denoting a right curve and a maximum safe speed of 40 mph. Weather conditions were daylight, slightly foggy, and dry pavement. At about 6:45 am on June 27, 1974, the truck, travelling northbound, was negotiating the right hand curve on a 10° downgrade, when the driver applied the trailer brakes. The empty flatbed trailer skidded and bounced into the opposing traffic lane, leaving 186 feet of skid marks. At this point, the southbound Volkswagen collided with, and ran under the truck, bursting into flame when the forward mounted fuel tank hit the truck. The car was dragged for a distance of 224 feet. The car's three passengers were killed. Accident investigation disclosed that the driver of the truck had been on the job only three months. Prior to that time, he had had no truck driving experience, and had only recently completed a truck driver training course, which consisted of only 30 hours of actual driving. It was concluded that the accident occurred due to a loss of control of a truck by an inexperienced driver who utilized his trailer brakes only, and that the truck was not being driven in accordance with the posted 40 mph. limit. In all probability, the driver could have maintained the proper speed and control of his vehicle either through the use of the truck's full braking system or gears. It is recommended that a driver not be considered either experienced or trained after three weeks of instruction. Moreover, some truck driving training schools have been lax in providing proper training. In order to reduce accidents of this type, motor carriers are urged to institute programs of monitoring newly employed drivers to ensure that the novice drivers are capable and qualified to handle the equipment and responsibilities of a professional driver.

Federal Hwy. Administration, Bureau of Motor Carrier Safety,
Washington, D.C. 20590
Rept. No. BMCS-74-5 ; 1975 ; 11p
Availability: Corporate author

CAR CARE. HOW TO TRAVEL WITH KIDS AND PETS [SAFETY SEATS AND INFANT CARRIERS]

Proper arrangements for children and pets can not only make them safer in an accident, but doing the job right may often-times prevent the accident from occurring in the first place. All child restraint systems must now meet federal standards. For children up to 20 lbs., a GM Love Seat Infant Carrier or Peterson 75 Safety Shell, belted into the back seat, facing the rear with a lap belt, meets these regulations. Most car companies offer larger seats for children up to 50 lbs. After that, a regular lap belt can be used, often with a hassock on the seat, so that the child can look out the window, and the lap strap can come across the hips at the correct angle. When a child has reached 4 ft. 6 inches, he should also use the shoulder strap. Children should never ride in the lap of an adult. In a crash, weight is multiplied 10 to 20 times, so a 10 lb. infant develops an inertia of 100 to 200 lbs. in an impact. Pets are even more important to restrain from a standpoint of driver distraction. Cats should be placed in a travel case, placed on the back floor, never on the seat. Larger pets should be trained to sit on the floor in back. Tranquilizers should also be considered, since a pet, jumping from seat to seat, or barking out the windows is a great distraction to the driver. And in the event of a sudden stop or impact, a large dog in the back seat can exert considerable force flying forward.

by Tom Tappett

Publ: Mechanix Illustrated v71 n567 p68, 70, 80 (Aug 1975)

Availability: See publication

OBSERVATIONS OF PEDESTRIAN BEHAVIOUR [BEHAVIOR] AT FOUR SITES

A method was devised for collecting and analyzing, on a large scale, data relating to the behavior of children and adults in road crossing situations at four different sites through the use of filming and time lapse photography at the sites. Film records were made of 1790 pedestrian crossings, which occurred in the half hour periods before and after school. Factors recorded for the study were: sex; age; social situation alone, in a group, or child accompanied by an adult; curb approach (walking or running); number and direction of head movements upon approach; length of delay at the curb; length of delay at the curb after a vehicle has passed; mode of crossing (run or walk); number and direction of head movements while crossing; direction of crossing (angle or straight); me taken to cross road; traffic situation at the time of crossing; and start and end of crossing in relation to group leader if accompanied. From the study, it was found that: adults tended to make an assessment of the road situation before reaching the curb, while children, particularly those of primary school age, seemed unwilling or unable to use this strategy. Children conformed more to the recommendation of a local crossing code than did adults. Adults and children differed in both the time and the manner of crossing the road.

all four sites, adults were more likely than children to start cross before the road was clear of vehicles. Adults rarely crossed a road, but were more likely to cross at an angle in children. The social situation of the child (whether alone accompanied) had an effect on his behavior. Fewer head movements were observed in approach or crossing when the child was accompanied. Crossing behavior of secondary school

children was more like that of adults than of the younger children. Sex differences in crossing behavior were only infrequently observed, when it was observed that boys adopted the adult crossing strategy earlier than girls. The example given by adults to children was often very unsatisfactory, since many adults crossed in a manner exactly contrary to what they had taught their children.

by G. B. Grayson

Transport and Road Res. Lab., Road User Characteristics Div., Crowthorne, Berks., England
Rept. No. TRRL-LR-670; 1975; 35p Srefs
Availability: NTIS

BUS USE OF HIGHWAYS. PLANNING AND DESIGN GUIDELINES

Planning and design guidelines for efficient bus utilization of urban highway facilities are presented. The guidelines reflect a review of more than 200 bus priority treatments in the United States and abroad, and provide a single reference source of information on bus priority treatments. Buses are the dominant form of public transport in the cities of the United States, carrying more than 70% of all transit riders. In terms of the dimensions of bus use: buses carry an average of about one-half of all peak hour travelers over the expressways and bridges of many large cities such as New York, San Francisco, and Washington, D.C.; they carry an even higher proportion of peak hour travelers on city streets; and urban bus terminals serve heavy peak hour movements. Bus priority treatments can be grouped into the three broad categories of freeways, arterials, and terminals, with successful treatments being characterized by: intensively developed downtown areas with limited street capacity and high all-day parking costs; a long term reliance on public transport; highway capacity limits on approaches to downtown; major water barriers that limit road access; fast nonstop bus runs for considerable distances; bus priorities on approaches to or across water barriers; special bus distribution within the central business district; and active traffic management and operations programs. Bus priority measures should be viewed as an integral part of overall transportation management strategies that deal with streets, parking, and public transport. Planning for new bus priority facilities depends on: growth prospects of the city center; potential future reliance on public transport; suitability of existing roadways for bus service; public attitudes; balancing of investment with demands; and the ability to meet the future overloads on roadways by new road construction. Efficient use of urban highways calls for maximum person flow with minimum net person delay over the long run. A major emphasis should be placed on operation treatments rather than physical construction wherever conditions permit.

by Herbert S. Levinson; Crosby L. Adams; William F. Hoey
Wilber Smith and Assoc., New Haven, Conn.
Rept. No. NCHRP-R-155; 1975

Sponsored by the American Assoc. of State Hwy. and Transportation Officials, in cooperation with the Federal Hwy. Administration.

Availability: TRB \$7.60

HS-017 196

MOTORCYCLE FACTS

In 1973, motorcycles (here including motor scooters, and motorized bicycles) comprised 3.3% of total vehicle registrations, 1.4% of the vehicles in motor-vehicle accidents and 4.7% of all vehicles involved in fatal accidents. Deaths of motorcycle operators and passengers totaled 3,130. Since 1961, motorcycle registrations have increased 609%. Deaths of motorcycle riders have increased 16%, from 1972 to 1973. The mileage death rate in 1973 was about 16 deaths per 100 million miles of motorcycle travel. The motorcyclists' chances of death or injury are greater than the driver of a vehicle affording more protection. Collision with another motor vehicle is the predominant type of motorcycle accident, and in such collisions, the driver of the automobile most often did not see the cyclist in time. Non-collision accidents, such as running off the road, were next in importance. For drivers of all vehicles, failure to yield right-of-way was the chief cause of accidents, with speeding the chief cause of fatal accidents. Motorcycle accidents most often occurred between 4 and 6 pm, and Saturday was the worst day of the week. The months of June through August had the highest number of motorcycle accidents, and the road conditions were predominantly dry when accidents occurred. The majority of cyclists involved in accidents are under 25 years of age, and have had a minimum of driving experience, since motorcycles have only recently become widely popular. Most cyclists were males, but a significant percentage of injuries and fatalities, about 15 to 20%, were females. Limited information is available to indicate if they were passengers. Borrowers of motorcycles were involved in about 23% of the reported motorcycle accidents. Parts of the body most often injured were the head, arm and leg. Recommendations for safety are made: maintaining proper speed, wearing protective headgear and clothing, and being aware of motor vehicle operators who may not be paying attention.

National Safety Council, Statistics Div., 425 North Michigan Ave., Chicago, Ill. 60611
1974 ; 9p 20refs
Availability: Corporate author

HS-017 197

VEHICLE DAMAGE SCALE FOR TRAFFIC ACCIDENT INVESTIGATORS. 2ND. ED.

This manual provides a scale for assessing damage sustained by motor vehicles in traffic accidents. The most common types of damage are rated on a scale from 1-7, with 1 being the least severe. The vehicle damage scale consists of photographs of automobiles damaged in accidents, with a separate page for each of the common impacts that investigators are likely to encounter. In order to rate damage on a vehicle, the investigator selects the proper page of photographs and attempts to match damage of the subject vehicle with one of the photographs. There is also a diagram of a car and an arrow or series of arrows showing direction of the principal impact force and a symbol to indicate the part of the vehicle damaged and type of impact. Damage generally limited to dents in body sheet metal and trim receive a rating of 2. Damage which consists of crumpling of body sheet metal, but little or no distortion of the basic structure or frame receives a rating of 4. When sheet metal is severely distorted or torn, and the basic structure of the car is distorted with some penetration of the passenger compartment, the accident rating is 6. 1,3,5, and 7

ratings are used for indication of a greater or lesser degree of damage than is illustrated in the manual.

National Safety Council, Traffic Accident Data Project, 425 North Michigan Ave., Chicago, Ill. 60611
Rept. No. NSC-TB-1 ; 1971 ; 32p
Availability: Corporate author

HS-017 198

[WYOMING] TRAFFIC ACCIDENT FACTS 1974

Tables for Wyoming traffic accidents are provided. Charts for the years 1965-1974 include Wyoming road accident vital statistics; a fatality rate graph; and a traffic accident and casualty graph. A cost of accident graph is provided for the time period 1969-1974. The 1974 traffic accident facts include the following tables: cost of roadway accidents; accident severity by county; accidents and casualties by county and roadway system; type of motor vehicles and the registration involved. The type of accident is broken down into sub-headings which include accident by roadway system-statewide and on-roadway-off-roadway accidents in urban, rural and statewide areas. Other tables show the injury severity by seat belt usage and seating position; accidents and casualties by month; hour of day; and day of week; contributing factors in the condition of the driver, the vehicle, and the road; and light and weather conditions. Statistics on drivers were grouped by residence; age; sex; city population; age distribution of casualties; teenage involvement; and direction and accident analysis for the 15-19 age group in urban areas and rural areas. Motorcycle accidents are mentioned, including statistics on the type of accident; the age of the driver; the severity of the accident; and accidents by county per registration. School bus accidents, showing type of accident and road conditions; truck accidents showing type of accident and road conditions; and pick-up accidents by county, and extent of injury in this type of accident vs. seat belt usage, are also charted. The last presentation is a spot map of fatal motor vehicle accidents for the State of Wyoming for 1974 is included.

Wyoming State Hwy. Dept., Hwy. Safety Branch, P.O. Box 1708 Cheyenne, Wyo. 82001
1974 ; 46p
On cover: "Wyoming Traffic Accident Facts 1974".
Availability: Corporate author

HS-017 199

HOW NOT TO BE HAD-ON AUTO REPAIRS

Tips on avoiding auto repair rip-offs are presented. One of the best ways to protect against unwarranted and expensive repairs is to know how a car works, and to diagnose and repair minor problems yourself. Automotive basics is taught at most community colleges and can be found in basic auto mechanic books and do-it-yourself service manuals which come with many new cars. Keeping your car properly maintained is another way of cutting down on the need for major repairs, and preventing breakdowns in out-of-the-way places, which can necessitate towing. Unscrupulous mechanics who know that you are stuck in the unfamiliar area, may try to tell you that expensive repairs are in order. Oftentimes, too, the tow-truck operator has you sign a form that says he or his designee must do the repair work. Keep a log of repair work and maintenance by date and mileage, and schedule maintenance for parts and service to correspond with car warren-

ties. Find a good mechanic, either through the recommendations of your friends, or by contacting the Better Business Bureau. When you find something wrong with your car, communicate the symptoms to the mechanic, rather than telling him what work should be performed. For example, you may merely need a brake adjustment, so you should avoid telling the mechanic that you need new brakes. Mark parts that you know will need replacement, then ask to see the parts when the work is completed. Some garages try to show you spare parts lying around the garage, and charge you for parts they have not replaced. Specialty shops such as radiator or electrical shops are often better equipped to work on a particular problem than the average mechanic. Many times, worn out parts can be replaced with rebuilt ones, such as starters and alternators, which are almost as good, and less expensive, as new ones. Any time you need repairs, and you are not sure where to go, try an auto service center at one of the department stores. They generally offer high-quality work at competitive prices. Mechanics at these centers generally work on a straight salary with no commission, so they most likely will take their time and do just the job you need.

Publ: Driver v9 n2 p8-12 (July 1975)
1975

Availability: See publication

HS-017 200

RIDE SAGELY

The basis for safe motorcycle riding is defensive driving based on attention and anticipation. Most cyclists involved in accidents are either under-experienced or over-confident. Defensive driving consists of several basic safety strategies and rules of the road. The most basic is following basic traffic regulations such as speed limit, passing, following too close and using the rear view mirror. Many states now require cyclists to be properly licensed for motorcycle use, which adds to cycle awareness. The alert biker should maintain a flow of traffic pace on his bike, while keeping his distance and not allowing other motorists to tailgate. If a driver is tailgating, the cyclist should tap his brake pedal several times, signal to the driver to keep his distance, or slow down and let the driver pass altogether. A motorcyclist should position himself to the left side of the lane. This practice enables the cyclist to avoid oil drippings and debris in the middle and right of the lane, and places the cyclist's reflection in both the inside and left outside rearview mirror of the car ahead. Be constantly aware of the road surface, and ready to slow down on curves and accelerate when you come out of it. When riding the extreme left hand lane on a freeway in moderate to heavy traffic, it is better to switch to the right-hand side of that lane to avoid being crowded by the divider and reducing the possibility of an automobile driver trying to squeeze by. When faced with the choice of ramming another automobile or a motorcycle, the auto driver is more likely to take his chances on the motorcycle.

by Roger Hull
Publ: Driver v9 n2 p14-8 (July 1975)
1975

Availability: See publication

HS-017 201

THE PEOPLE'S CAR

Because of a changing economy, fuel shortages, and materials shortages, the approach to vehicle design may have to take a new approach. The future automobile will have to be based on the concept of value, incorporating the features of comfort; good fuel economy; low exhaust emissions; maximum interior space; minimum exterior bulk; durability; reliability; serviceability; crashworthiness; and collision avoidance. The car of the future basically, will be a front wheel drive, "sport wagon", which is shorter, higher and narrower than cars today. It will comfortably accommodate 4 adults and luggage. It will have a 110.0 inch wheel base, and a length of 170.0 inches. The 12 gallon capacity tank will allow long mileage at 30 miles per gallon of low exhaust emission driving. And it should be designed to last from 10 to 20 years. The engine will be a two-rotor supercharged Wankel, operating on either diesel or stratified-charge principle. The underbody and chassis will be a unitized structure of stamped and extruded aluminum components, for rust and corrosion resistance. Exterior body components would be made of color-impregnated injection-molded plastic, which have better dent resistance. Adjustable-seats, accelerator, brake, clutch and steering controls are all standard. In the model proposed, an outstanding feature is the articulated gullwing doors, hinged at the roof center and beltline, which offer the advantage of large sliding windows, side impact protection, and economy in the cost of injection mold, tooling of the doors.

by Chris Theodore
Publ: Road and Track v26 n12 p44-6 (Aug 1975)
1975
Availability: See publication

HS-017 202

ASSISTIVE SYSTEMS FOR DISABLED DRIVERS: A STATUS REPORT

A number of assistive systems for disabled drivers are listed. The most numerous are the standard hand control systems which are designed so that both the brake and throttle can be operated with one hand. In most cases, the right hand is used exclusively for steering. A representative list of manufacturers and the basic cost of their equipment is attached. There have been a number of studies on accident records which reveal that current disabled drivers do not have an accident record significantly different from that of the general population. For individuals who do not have sufficient strength in their arms and upper body to make a wheelchair-car-wheelchair transfer there are vans with some type of power lift which allows them to stay in the wheelchair. In addition to systems which consist of a van with a powered lift and hand controls for driving, there exist several new systems: van with a joystick control for acceleration and braking and a small relocated steering wheel which provides lock to lock motion of the front wheels with less than one revolution of the steering wheel; a foot steering system for drivers with only one arm as a functional limb, which utilizes a steering wheel located on the floor with a foot pedal which is pivoted in a manner similar to a steering knob; and a prototype van which uses a two axis joystick

similar to that on an electric wheelchair to control the primary functions of steering, acceleration, and braking.

by M. McDermott, Jr.; W. A. Hyman; Paul H. Newell, Jr.
Texas A and M Univ., Industrial Engineering Dept., College
Station, Texas 77843
Contract VA-V-101-(134)
Rept. No. TR-052274 ; 1974 ; 16p
Availability: Corporate author

HS-017 203

IMPLEMENTING COMPUTER SIMULATION OF TRAFFIC SIGNAL SYSTEMS

An Urban Traffic Control System-1 (UTCS-1) simulation system has been used by the Federal Highway Administration in several cities to help predict the consequences of new traffic control strategies without the disadvantages of conventional methods of traffic flow control, such as: the need for individual implementation of control plans; the need for comparison of data before and after implementation of the control plan; the trial-and-error conditions that may be imposed on traffic flow, resulting in congestion, which will require further time to change to another pattern; and the fact that conditions affecting traffic flow may vary significantly between the time data is collected and the time a control system is implemented. In May 1973, the Utah State Department of Highways undertook a project to apply simulation to solve some of their traffic flow problems. The UTCS-1 computer simulation program, incorporating roadway and traffic flow characteristics in great detail, was applied to a portion of Utah's Redwood road network. The network included three signalized intersections, but was small enough so that simultaneous vehicle counts could be taken at road entrances. After obtaining field data, a link and node diagram was prepared corresponding to the traffic flows within the network. Error detection and correction procedures were also developed because of the difficulties met in data preparation. A quantitative measure for comparison between the simulation and observed traffic flow was necessary to judge the validity of the method, and it was found that most of the computer generated values were within 10% of observed counts. The largest differences were associated with the imbalance in the network where the number of vehicles entering one link were much different from the number observed leaving the same link. A statistically independent set of differences was chosen for further comparison, and it was found that the difference between the distributions was not significant at a 90% level. A paired t-test was judged valid for comparing the differences, and it showed no significant difference at a 10% level of significance.

by W. J. Kennedy, Jr.; Ralph M. Farr; Willard D. Labrum
Publ: Traffic Engineering v45 n7 p44-6, 48, 50 (Jul 1975)
1975 ; 3refs
Availability: See publication

HS-017 204

TRAFFIC DIVERSION FOR BETTER NEIGHBORHOODS

The City of Seattle has subdivisions plotted in a grid configuration which presents a problem since all the access streets are open for use to both local and through traffic, resulting in an increase in accidents and traffic volumes on interior neighborhood access streets. A coordinating team from Seattle's De-

partment of Community Development, Engineering, Parks and Recreation, Building, Water and Lighting was organized to determine the feasibility of operational improvements in the neighborhoods. The concept of street re-use was developed, based on the philosophy that a contiguous group of land owners have the right to enhance the quality of urban life by incorporating common desired uses in the area dedicated for traditional street purposes. The degree of street development is flexible, depending upon the needs of the area residents. If a group of neighborhood residents desires to develop a traffic circle, cul-de-sac, or traffic diverter of some type to control traffic, a majority of property owners within the affected area must give their approval. Interest in the project on both city and neighborhood levels seems to indicate that the concept, so far, has been a success.

by Lloyd C. Orlob
Publ: Traffic Engineering v45 n7 p22-3, 25 (July 1975)
1975
Availability: See publication

HS-017 205

EMISSIONS PATTERNS OF DIESEL-POWERED PASSENGER CARS

The gaseous and particulate emissions from a light-duty diesel powered passenger car (a 3,500 pound, four door sedan powered by a Nissan, naturally aspirated, indirect injection engine) were measured under both 1975 Federal Test Procedures and highway fuel economy test procedures, as described in the Federal Register. A variety of chemical analysis techniques tested three different fuels; typical No. 1 and No. 2 commercial diesel fuels and the Federal Register No. 2-D smoke test fuel. Hydrocarbon (HC) emissions were found to be inversely related to fuel molecular weight. The nitrogen dioxide (NO₂) and nitric oxide (NO) ratio was found to be much higher than for gasoline engines approaching 0.3 at low load. Particulate emissions were approximately 0.3 grams per mile for all fuels and driving cycles tested. Sulfate emissions were high, approaching that of some catalyst cars. Sulfate emissions decreased with decreasing fuel sulfur and increased by a factor of two in highway driving over urban driving. The potential pollution problems of such cars are worthy of further study. The following was concluded: diesel-powered cars have low regulated emissions and good part-load fuel economy; HC emissions appear to increase with decreasing fuel density and/or viscosity with the Nissan diesel powered car; aldehyde emissions appear to be significantly higher than previously thought and constitute an appreciable fraction of the oxidant potential of diesel exhaust; light HC's are mainly ethylene and do not make up a significant amount of the total hydrocarbons emitted; although NO yields are low, NO₂ makes up a significant fraction of the total, particularly at low speed with this car; particulate yields are about 0.3 grams per mile and consist mainly of elemental carbon; sulfate yields are similar to those of production 49-state catalyst cars operated on the currently available lead free gasolines and decrease linearly with decreasing fuel sulfur; trace metals and other emitted elements are of little consequence and account for no significant fraction of the total particulate mass.

by James N. Braddock; Ronald L. Bradow
Environmental Protection Agency
Rept. No. SAE-750682 ; 1975 ; 20p 9refs
Presented at the Fuels and Lubricants Meeting, Houston, Texas, 3-5 Jun 1975.
Availability: SAE

HS-017 206

WHY DRIVERS HAVE ACCIDENTS

Causal factors in traffic accidents according to a paper published in 1972 "The Aetiology of Traffic Accidents" are as follows: environment 4.3%; vehicle 4.3%; road user 44.7%; environment and vehicle 1.0%; environment and road user (driving in fog or rain, for example) 31.1%; vehicle and road user interaction 7.1%; and a combination of environment (weather, road conditions), vehicle and road user 7.6%. This shows that the greatest cause of traffic accidents is the road user. The errors made by the road user break down as follows: failure to look 28.0%; misperception 18.0%; excessive speed 24.8%; panic reaction 8.7%; other errors in decision, 18.6%. Implementation, or wrong usage of a particular control on the vehicle accounted for no errors. Use of alcohol before or during driving, and alcoholic drivers contribute significantly to the commitment of many of the road user errors. In general terms, the two biggest strides forward that are both economically viable and socially acceptable are to enforce the wearing of safety belts, thus diminishing the injuries and deaths; and to clamp down strictly on drunk driving.

by Chris Goffey
Publ: Autocar v142 n4103 p18-20 (28 Jun 1975)
1975
Availability: See publication

HS-017 207

SCREENING DRIVERS FOR ALCOHOL--AN APPLICATION OF BAYES' FORMULA

The initial effectiveness of the British Road Safety Act of 1967 in reducing fatal crashes led to the adoption of the idea of screening drivers for alcohol in other countries. This effectiveness has been decreasing lately, however, due in part to a change in the perception of the risk of getting caught. Sweden proposed legislation which would permit random screening of drivers. A study was made of the feasibility of such a program, based on the assumption that disposable devices and the Breathalyzer would have a probability of zero of producing a false result when the actual blood alcohol content is equal to zero. Tables of screening test results for accident and nonaccident drivers were compiled. The results indicate that even if random screening increases the risk of being caught, it will, at the same time, substantially increase the rate of false arrests due either to the fact that the test method is subject to error rates, or that many drivers would have blood alcohol contents less than the legal limit.

by Brian O'Neill; Richard S. Eiswirth
Publ: American Journal of Public Health v62 n11 p1468-72 (Nov. 1972)
1972; 12refs
Availability: See publication

IS-017 208

**MULTIDISCIPLINARY ACCIDENT INVESTIGATION.
CHEVELLE CAR-CHEVROLET SCHOOL BUS
APPROACHING**

An accident is investigated in which a 1965 Chevrolet school bus, westbound on a rural arterial highway, collided with an eastbound 1971 Chevelle, which had lost control during hard

brake application and drifted into the path of the bus. The driver of the Chevelle sustained moderate injuries, requiring 17 stitches to the head. Some occupants of the bus sustained minor injuries, others were uninjured. The driver of the Chevelle was a 19 year old male with 1 year driving experience and no driver education training. He was wearing a lap belt. The vehicle he was driving had no defects, and he had been driving it for about 3 months, 8,000 miles. The driver of the school bus was a 34 year old female with 18 years driving experience, one month on the school bus. She had no driver education training, and had been given a short bus training by the bus company. The vehicle she was driving had no defects, and she had been driving it for about 1 month, 1,000 miles. She was not wearing any restraints. Weather was clear; roadway was asphalt, dry, with a slight upslope just before the crest of the hill; and it was daylight. A witness claims that the Chevelle approached the slow moving traffic (30 mph on 60 mph road) too fast, and lost control while trying to stop quickly and drifted into the path of the bus. No precrash skid marks were found on the road. Damage to the Chevelle was \$2,300, to the bus \$2,900. Damage to the right side of the Chevelle, maximum penetration 28 inches, roof and left rear quarter panel by telescoping, frame was distorted. The whole front of the bus's front axle was displaced to the rear on the left side. Charts summarizing collision performance and injury reports show that only the driver of the Chevelle was hospitalized over night, 13 bus passengers were treated and released, the rest were uninjured.

by Merritt M. Davis; Lawrence Black
University of Toronto, Dept. of Civil Engineering, Toronto, Ontario, Canada
Grant 98478
Rept. No. TOR-056-74; 1974; 120p
Includes French resume. Prepared for the Director of Road and Motor Vehicle Traffic Safety, Ministry of Transport, Ottawa, Canada.
Availability: Director, Road and Motor Vehicle Traffic Safety, Ministry of Transport, Ottawa, Ontario, Canada

HS-017 209

MINIATURE PROBES FOR USE IN GAS TURBINE TESTING

Design details, general characteristics, and discussions of applications and limits are presented for a wedge-type combination probe, a tube-type combination probe, and two temperature probes (a semi-shielded high recovery probe, and a bare-wire thermocouple probe). These miniature probes have proved useful in aircraft and space power systems component testing and are applicable to automotive gas turbine testing. The probes are used to determine component or system performance from the measurement of gas temperature, as well as total and static pressure, and flow direction. Detailed drawings of the sensors and experimental data covering the flow characteristics over the range of intended use show that for static pressure measurement it is desirable that the sensing element be many diameters upstream from the probe support since the probes must usually pass through a small hole and have the sensing elements near the centerline of rotation. Most small combination probes do not include the ability to measure stream static pressure, but if it is required that the combination probes have the ability to measure static pressure, the wedge type is preferred, since its angle ports indicate

a pressure much closer to stream static pressure than the tube type.

by George E. Glawe; Lloyd M. Krause
Lewis Res. Center, National Aeronautics and Space
Administration
Rept. No. SAE-750094 ; 1975 ; 8p 7refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 210

HIGHWAY ROBBERY: RETROFIT SMOG DEVICE FIASCO

In 1966, anti-nitric oxide legislation was introduced in California, and motorists were required by law to have smog devices fitted to their automobiles. Unfortunately, with hundreds of thousands of cars to fit, the load on the state's auto repair industry was severe, causing misinstallation of many units. Initially, spot checks of motorists which revealed failure to comply with the legislation, resulted in the issuance of a 30 day warning, during which time the vehicle had to have an anti-smog device installed. A low level of compliance resulted in a mandatory program which required vehicles to be brought in according to the last digit on the license plate. (If the last digit was "1", the vehicle had to be brought in in January, and so forth). Not only was the requirement for the anti-smog device costly in terms of installment charges, but it also resulted in higher fuel consumption. In April, 1974, the entire bill requiring the devices was repealed, after findings that the nitric oxide devices were not reducing emissions as much as earlier tests had indicated.

by Daniel Judge
Publ: Motor Trend v27 n8 p38-41,110 (Aug 1975)
1975
Availability: See publication

HS-017 211

GUIDELINES FOR THE EVALUATION OF EVIDENCE SUBMITTED IN SUBSTANTIATION OF ADVERTISING CLAIMS MADE BY THE AUTOMOTIVE INDUSTRY. FINAL REPORT

A technological basis for the evaluation of evidence presented in the substantiation of advertising claims dealing with the motor vehicle is delineated. Methodology for evaluation consists of four phases: interpreting the claim; defining the required measures; describing adequate procedures for the measurement process; and rendering an opinion on the result. Four claim categories are presented and discussed separately: motor vehicle ride claims and substantiation; motor vehicle handling claims and substantiation; motor vehicle performance claims and substantiation; and economy of operation claims. Evaluation reduces the words of the claims to engineering terms acceptable to the scientific community and precise enough to be subjected to rigid testing. Criterion values of measures are then defined, using relevant engineering standards. Establishment of measurement procedures capable of resolving and comparing substantiating evidence is the next step. The final stage is transformation of engineering analyses of the problem into a format understandable to a non-technical audience. In the case of evaluation, the procedure consists of two parallel operations. The first is assembling the evidence

offered to substantiate the claim by its maker, and the second is formulating ideal evidence which will be different for each of the claim categories, to be used in the evaluation process.

by Richard J. Kaplan; Duane F. Dunlap; Robert D. Ervin;
Leonard Segel; Christopher B. Winkler
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48105
Rept. No. UM-HSRI-PF-73-4 ; 1973 ; 53p
Prepared for the Consumer Interests Foundation, 1625 Eye
St., N.W., Suite 923; Washington, D.C. 20006.
Availability: Corporate author

HS-017 218

IDENTIFYING COMMUNITY TRANSPORTATION CONCERNS

Factor analysis was used as a research technique for identifying community concerns regarding transportation. Factor analysis is a set of methods for analyzing a table of intercorrelations. It is understood that the ideas and opinions of the general public must be considered in any attempt to increase transit ridership; therefore a process of evaluation employing factor analysis was created. To the extent that opinions expressed by the respondent group of 400 randomly chosen individuals in Dayton, Ohio can be applicable to all urban populations, the major concerns of transit users, as reflected in the answers to a 34 point questionnaire regarding various transportation issues were as follows: the desires for increased services, de-emphasis of the automobile, increased safety in automobile travel, and improved environment, and the avoidance of taxing automobile users to combat air pollution. There were also beliefs that there should be: a multipurpose transportation system; a nonprofit public transport system; and rail transit. To the extent that the opinions expressed do not reflect the opinions of other communities, factor analysis was a very useful research technique for identifying the transportation concerns of those communities as well, providing a statistically supported basis for transportation system decisionmaking, taking into account the major concerns of the people to be served by the particular system.

by Alan L. King
Publ: Traffic Quarterly v29 n3 p317-31 (Jul 1975)
1975 ; 7refs
Produced as part of a prog. of res. and training in urban
transportation sponsored by the Urban Mass Transportation
Administration.
Availability: See publication

HS-017 219

ANALYTIC TIRE MODEL. PHASE 1: THE STATICALLY LOADED TOROIDAL MEMBRANE

A final report on the development of a preliminary analytic tire model which is an isotropic toroidal membrane with inner edges bonded to rigid bead rings, is presented. The toroid is inflated and deflected against a frictionless flat surface, and solutions are obtained for: the deformed shape and contact boundary; strain and stress distributions, including principal stresses; normal (hoop and radial) and shear stress distributions on the bead ring; and tire load as a function of inflation pressure and loaded radius. The computer programs used to find solutions are also included. Major benefits in calculations were found in the virtual work equation, especially the fact that: the phenomenological theory of material properties is

HS-017 220

directly utilized as the strain energy density whose first variation is set equal to the virtual work; and there is no need to explicitly derive a potential functional whose first variation is the virtual work of external loads. It was found that cord reinforcements allowed calculations for the influence of cord path on the direction of principal stress in the vicinity of the contact region, adding to the flexibility of the model. Significant extensions of this model are required to yield the deformation and stress of the loaded rolling tire. The additional effects, of primary importance in rolling tire performance, were found to be: centrifugal forces; rheological forces; and tangential forces produced by sliding friction. The effect of centrifugal force on the axisymmetric shape of an inflated cord reinforced membrane model of a tire has been previously studied. The continuum aspects of the centrifugal force formulation could be incorporated into the analytic tire model. The introduction of rheological (time-dependent deformation) forces into the present analysis is possible by means of the dissipation potential. The extension of the analytic tire model would enable the rolling resistance of a tire to be calculated as a function of tire design and operating variables. It is also possible that the effect of sliding friction forces on tire deformation and stress can be analyzed by a dissipation potential.

by John T. Tielking
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48202
Rept. No. UM-HSRI-PF-75-7; 1975; 216p 30refs
Rept. for 30 Jul 1974-30 Jun 1975. Tire Traction Characteristics
Affecting Vehicle Performance: Interim Document 10.
Sponsored by the Motor Vehicle Mfr. Assoc.
Availability: Corporate author

HS-017 220

ROAD ACCIDENTS IN GREAT BRITAIN 1972

Statistical tables for road accidents in Great Britain are presented. The first group of tables shows casualty (fatality and injury) trends for 1962 to 1972, under the following headings: by class of road user (drivers, passengers, riders, and pedestrians), and severity of injury; for drivers and passengers, by severity of injury and type of vehicle; for drivers, two-wheel vehicle riders, and pedestrians, by age group; by time of day; for urban and rural areas, by lighting conditions; and for front seat occupants of cars and vans, by seat belt usage. The number and results of breath test for drivers involved in accidents are given for 1969 to 1972. A table showing population, the number of motor vehicles, and the number of accidents and casualties for 1934 to 1972 is included. Trend charts are also provided showing: accident involvement of trucks (1966 to 1972) and cars (1963 to 1972); the level of seat belt usage in cars and vans (1972 to 1973); the number of parked vehicles involved in night accidents (1969 to 1973); casualty severity by class of road user (1962 to 1972); and the number of pedestrian casualties per 100,000 population (1962 to 1972). The detailed tables for 1972 show accidents and casualties: by type of vehicle involved; by road surface and lighting conditions; for each month, by road surface condition; for urban and rural area, by class of road user; by class of road user, age and sex; for pedestrians, by age; for all users, by day of week and hour of day; for front seat occupants of cars and vans, by seat belt usage; and for pedestrians and drivers, by region, county, and large city. The types of vehicles involved; defects reported in involved vehicles; the actions and driving maneuvers attempted; and the experience level of the drivers and riders involved, are also tabulated in relation to accidents. A section of international comparisons

shows the road deaths and death rates in various countries in 1971.

Department of the Environment, Directorate of Statistics, 2
Marsham St., London, SW1P 3EB, England
1974; 70p
Availability: Her Majesty's Stationery Office, PM1A (ZRI),
Atlantic House, Holborn Viaduct, London EC1P 1BN,
England

HS-017 221

ROAD ACCIDENTS, GREAT BRITAIN, 1973

Statistical tables for road accidents in Great Britain are presented. The first group of tables shows casualty (fatality and injury) trends for 1963 to 1973, under the following headings: by class of road user (drivers, passengers, riders, and pedestrians), and severity of injury; for drivers and passengers, by severity of injury and type of vehicle; for drivers, two-wheel vehicle riders, by age; for pedestrians by age and sex; by time of day; for urban and rural areas, by lighting conditions; and for front seat occupants of cars and vans, by seat belt usage. The number and results of breath test for drivers involved in accidents are given for 1969 to 1973. A table showing population, the number of motor vehicles, and the number of accidents and casualties for 1934 to 1973 is included. Trend charts are also provided showing: accident involvement of cars (1963 to 1973); the level of seat belt usage in cars and vans (1972 to 1974); casualty severity by class of road user (1963 to 1973); and the number of pedestrian casualties per 100,000 population (1962 to 1973). The detailed tables for 1973 show accidents and casualties: by type of vehicle involved; by road surface and lighting conditions; for each month, by road surface condition; for urban and rural area, by class of road user; by class of road user, age and sex; for pedestrians, by age; for all users, by day of week and hour of day; for front seat occupants of cars and vans, by seat belt usage; and for pedestrians and drivers, by region, county. The types of vehicles involved; incidence of skidding; vehicles involved, by month, and road conditions; the actions and driving maneuvers attempted; and the experience level of the drivers and riders involved, are also tabulated in relation to accidents. A section of international comparisons shows the road deaths and death rates in various countries in 1971.

Department of the Environment, Directorate of Statistics, 2
Marsham St., London, SW1P 3EB, England
1974; 66p
Availability: Her Majesty's Stationery Office, PM1A (ZRI),
Atlantic House, Holborn Viaduct, London EC1P 1BN,
England

HS-017 222

**AN EVALUATION OF SPEED-CURTAILING BUMPS
[SPEED BUMPS]**

A series of objective tests undertaken to evaluate the feasibility of installing speed bumps on city streets. Manpower, time, and money was limited, so the scope of the study was restricted to evaluating the potential effectiveness of various types of speed bump configurations in reducing vehicle speeds. Eleven different vehicles were employed in the study, eight of which represented the type of traffic which would be found on a residential street. They were as follows: a bicycle; a 750cc and 250cc motorcycle; a 1973 Chevy Vega; a 1969 Ford Galaxie; a Volkswagen; a 3/4 ton pick-up; a Dodge van;

a 2-ton international dump truck, a 2000 1,000-gallon per minute pumper fire truck; and an International two-axle bus. These last three vehicles were used to see what effect the speed bumps would have on the operational safety of city vehicles. The following results were obtained: the speed bumps tested were not effective in reducing vehicle speed; they presented a specific hazard to some vehicles such as bicycles and motorcycles; they were a danger to firemen riding on the back of fire trucks; a new dump truck began to fall apart after hitting a severe bump; and, in some cases, the bumps caused a 10 to 20 decibel sound level increase over the sound level of the standard residential neighborhood.

by A. R. Turturici

Publ: Public Works v106 n8 p73-6 (Aug 1975)

1975

Availability: See publication

HS-017 223

IMPROVING THE DIESEL ENGINE

An analysis of noise, exhaust emissions, and fuel consumption between direct and indirect injection, diesel engines was made by Daimler-Benz using a Mercedes V-10 truck engine with direct injection (DI) and an identical engine with indirect injection (IDI), using a pre-chamber principle. Curves were made on engine noise, running at full load with constant injection timing, and it was found that the predominant factor in overall noise level of a DI engine is combustion noise, while the IDI engine combustion process adds only slightly to overall noise. Variance of the injection timing revealed that at 2500 rpm full load, the IDI engine becomes closer in noise characteristics to the DI engine, as injection timing is advanced. There were also changes in the levels of smoke, nitrogen dioxide and hydrocarbon emissions with change in injection timing, demonstrating further that a definite correlation exists between noise levels and exhaust emissions since both are affected by pressure rise. Another relationship was discovered between exhaust emissions, noise, and fuel consumption. The noise advantage of the IDI engine was achieved at the expense of about 10% higher fuel consumption. Furthermore, reducing the noise level of the DI engine will raise its fuel consumption too. The decision, then, is between the one-time cost of engine insulation and the constantly-recurring higher fuel costs of an IDI engine. The classic DI diesel, equipped with passive noise insulating barriers, remains the probable choice in future engine designs.

Publ: Automotive Engineering v83 n8 p24-8 (Aug 1975)

1975

Based on SAE-750772, "New Methods for Reducing Visible Emissions of Diesel Engines," by G. Fraenkle and H. O. Hardenberg, Daimler-Benz AG; and SAE-750796, "Noise, Emissions and Performance of the Diesel Engine—A Comparison Between DI and IDI Combustion Systems," by F. W. Leipold and H. O. Hardenberg, Daimler-Benz AG. Both papers were presented at the SAE Off-Highway Vehicle Meeting, Milwaukee, 8-11 Sept 1975.

Availability: See publication

HS-017 224

HYDRO-STATIC TORQUE CONVERTER FOR MOTOR VEHICLES (FULL RANGE AND FULLY AUTOMATIC)

A report on a hydro-static power transmission system for passenger cars, buses, and semi-trucks was made. The operating

characteristics demonstrated the following advantages: the deliverance of steplessly, variable output, speed-ratios ranging from under-drive to over-drive, in forward, and also under-drive in reverse; automatic changing of speed-ratios, while keeping the engine running at the minimum specific fuel consumption; development of a constant driving speed by automatic speed-ratio control; the production of maximum output power for driving the engine at a given throttle opening, affording maximum acceleration for starting, passing, and hill climbing; the freeing of hydro-static couplings at idle engine running or at inertia vehicle running; and the securing of a variable speed-ratio, so as to keep constant the engine speed, to afford effective braking power at all speeds. These functions were achieved by the combination of manual maneuver and automatic control.

by Akira Kobayashi

Publ: Bulletin of the JSME v18 n118 p367-75 (Apr 1975)

1975

Availability: See publication

HS-017 225

STATISTICAL STUDY OF TRAM DRIVER ACCIDENTS

This statistical study considers two basic hypotheses on industrial and traffic accidents—the accident proneness theory and the spell theory. The accident proneness theory supposes that there is a varying individual susceptibility to accident. The spell theory supposes that there may be periods of time during which people's performance in complex tasks is liable to be substandard, and during these times they are most likely to have an accident. The two hypotheses were tested on the basis of a correlation analysis of accident distribution in a group of tram drivers over a five year observation period. Using the chi-square goodness of fit test, the analysis showed the negative binomial distribution and the "short" distribution were successfully fitted, while the Poisson distribution significantly differed from the observations. Correlation analysis showed a significant correlation between the number of tram driver accidents over different periods. This correlation, although decreasing with an increase of the interval between observation periods, remained significant. The conclusion is that the proneness hypothesis explains more satisfactorily than the spell hypothesis the occurrence of accidents in tram drivers during the observation period.

by Stanisa Milosevic; Snezana Vucinic

Publ: Accident Analysis and Prevention v7 n1 p1-7 (May 1975)

1975 ; 8refs

Availability: See publication

HS-017 226

FACTORS RELATED TO MORTALITY FROM MOTOR VEHICLE ACCIDENTS IN EUROPEAN COUNTRIES IN 1970

An examination was made, for a number of European countries, of the relationship between mortality from motor vehicle accidents and certain demographic and transport factors, such as vehicles per inhabitant, length of road network per area, percentage of total population in large towns, and percentage of young (under 19) and old (over 65) in the total population. The statistical analysis was performed using a multiple regression technique. The factors studied accounted for about three-

fifths of the observed variation in mortality from motor vehicle accidents in European countries in 1970. Unknown factors, such as driver behavior at the time of the accident, and psychosocial conditions, did not seem to be as significant as sometimes assumed. A positive relationship between mortality from road accidents and the relative number of vehicles was reinforced. A positive relationship between mortality from motor vehicle accidents and the density of the road network was not expected and could not be attributed to a more direct relationship with the number of cars, since the intercorrelations between the independent variables were controlled by the statistical analysis. A positive relationship found between mortality and the proportion of private cars and taxis in total vehicles was unexpected, since it indicates a negative relationship between mortality and the number of motorcycles.

by D. Trichopoulos; A. Tschageas; J. Papadakis; V. Kalapothaki; A. Koutselinos
 Publ: Accident Analysis and Prevention v7 n1 p9-13 (May 1975)
 1975; 11refs
 Includes French resume.
 Availability: See publication

HS-017 227

WITNESSES' ESTIMATES OF THE SPEEDS OF TRAFFIC ACCIDENTS

Using fatal pedestrian accidents occurring in London in 1970-71 as data base, the usefulness of police reports for estimating the speeds of road traffic accidents was investigated. Two approaches were used: correlating estimates by different people of the initial speeds, and relating vehicle damage to estimated impact speed. The first approach established quite high correlations (around 0.6) between different estimates; and in the second a positive association was found between speed and damage. Furthermore, the average difference between estimates made by independent witnesses and by the drivers of the vehicles involved was small (3 miles per hour). In addition, a table is given showing the distribution of estimated impact speeds for this sample of accidents.

by T. P. Hutchinson
 Publ: Accident Analysis and Prevention v7 n1 p27-35 (May 1975)
 1975; 11refs
 Availability: See publication

HS-017 228

ACCIDENT PRONENESS

Reviews of research on accident proneness have concluded, over the last 20 years, that the contribution of the accident prone to the total accident problem is small, and that attempts to control accidents by elimination of accident prone individuals is basically useless. Attention to machine designs and the provision of appropriate safety equipment are more effective measures. A recent book, written by Lynette Shaw and Herbert Sichel, attempts to revive the issue of accident proneness among individuals. The arguments which were presented by the book are examined. The reviewer concludes that proper design of the man-machine system, with proper attention to the sources of human error, and proper protective devices for those who are unavoidably exposed to some risk, is far more effective. It is pointed out that the author's argument that accident proneness can only operate when the level of risk is

high, contains a chief contradiction. Also it was found that the subjects studied (bus drivers in South Africa) were found to be a unique group in that many of them were found to be undesirable prospects for employment after psychological and clinical evaluations. It is suggested that perhaps the book's authors have generalized from a specific set of circumstances to a general conclusion. It is concluded that safety is best served by endeavouring to reduce the element of risk. With low risk the problem of accident proneness disappears.

by Colin Cameron
 Publ: Accident Analysis and Prevention v7 n1 p49-53 (May 1975)
 1975; 5refs
 Availability: See publication

HS-017 229

A BAYESIAN ANALYSIS OF THE "ACCIDENT RATE POTENTIAL" PARAMETER

Using data from the accident experience of 122 Shunters (railway switchmen), each having had up to 25 years experience, and from 1964 California driver record study, confidence intervals are obtained by Bayesian analysis, such that some discrimination can be made between the accident rate potentials of individuals who have differing past accident records. In order to fully utilize the available bivariate information, inferences are made on individuals with a given number of accidents during 1963, while also using all previous accident information concerning these individuals during 1961-62. Two previously used methods of obtaining confidence intervals are compared to the Bayesian method and some further improvements in discrimination between accident rate potentials by more sophisticated use of prior parameters are recommended.

by William O. Williford; Henry E. Barton
 Publ: Accident Analysis and Prevention v7 n1 p55-62 (May 1975)
 1975; 9refs
 Availability: See publication

HS-017 230

THE CONVERSION OF SO₂ (SULFUR DIOXIDE) OVER AUTOMOTIVE OXIDATION CATALYSTS

Noble metal oxidation catalysts have been shown to convert gasoline sulfur to automotive particulate sulfate emissions. A study, using a bench scale reactor, was conducted to evaluate the effect of vehicle operating conditions and catalyst type on the conversion of sulfur dioxide to sulfur trioxide. Four factors influenced the sulfur dioxide conversion over the noble metal oxidation catalyst. They were: catalyst temperature, exhaust gas oxygen concentrations, residence time reported as space velocity, and catalyst type. The results were compared with data from a vehicular study designed to assess total sulfur emissions from catalyst-equipped cars. The study indicated that control of exhaust sulfate emissions could be achieved through close control of the oxygen content of exhaust gas and that the choice of catalyst affects the degree of conversion of sulfur dioxide to sulfur trioxide and the amount of oxidized sulfur retained in the catalyst system. Conclusions from the two testing phases were as follows. In the Laboratory phase it was found that: with monolithic noble metal oxidation catalysts at temperatures in excess of 800 degrees F, the con-

version of sulfur dioxide to sulfate approaches equilibrium conversions; monolithic noble metal oxidation catalysts yield sulfur dioxide conversions closer to equilibrium values than do pelleted systems; decreasing the oxygen content of exhaust gas dramatically lowers sulfur dioxide conversion to less than 20% near stoichiometric conditions; in both catalyst systems, reduced conversion is maintained while maintaining carbon monoxide and hydrocarbon conversion at a high rate; and space velocity has a minor and predictable effect on sulfur dioxide conversion over both types of catalysts. In the vehicle emission phase it was found that: a vehicle equipped with monolithic catalysts emits greater quantities of exhaust sulfate during the 1975 FTP and 40 miles per hour cruise conditions than does that vehicle when equipped with pelleted catalysts; and within the group of monolithic catalysts tested, there were significant differences between sulfur dioxide and sulfate ion yields and total sulfur balances, suggesting a dominant catalyst preparation role.

by M. Beltzer; R. J. Campion; J. Harlan; A. M. Hochhauser
Rept. No. SAE-750095; 1975; 11p 11refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 231

AUTOMOBILE INSURANCE LOSSES, COLLISION COVERAGES; INITIAL RESULTS FOR 1975 MODELS

Variations in the frequency and size of collision claims for damage to 1975 private passenger vehicles from 25 makes during their first nine months of availability are described. Data were supplied by six insurance companies, Allstate, Kemper, Liberty Mutual, Nationwide, State Farm, and Travelers. The total exposure for all makes and series was 116,794 insured vehicle years (IVY's). For the four major market classes (subcompact; compact, intermediate and full size) the exposures ranged from 12,463 to 30,121 IVY's. The 36 vehicle series (27 major market classes—five subcompacts, six compacts, eight intermediates, eight full size, and eight minor market class series—one luxury, four specialty, and three expensive specialty) that are summarized are those with more than 1,000 IVY's of exposure. The greater the exposure of a vehicle series the more confidence can be placed in the results presented for it. Results presented for each market class and vehicle series were standardized to the same distribution of exposure for each combination of deductible amount and operator age group. The subcompacts had the highest average loss payment (ALP) per claim and ALP per IVY. The order of the major market classes, going from lowest to highest, by claim frequency per one hundred IVY's, was compact, full size, subcompact, and intermediate. The order of the ALP's per claim, from lowest to highest, was full size, compact, intermediate and subcompact. The order of the ALP per IVY, from lowest to highest, was compact, full size, intermediate, and subcompact. Pronounced increases in ALP amounts were observed for the 1975 subcompacts compared with the corresponding 1974 models. The subcompact ALP for 1975 models showed an increase of 30% over 1974 subcompacts, while the increases for the other market classes ranged from 11% to 17%. Consistent increases in claim frequency were also observed for the 1975 model market classes and individual series. As with the results from previous model years, the three minor market classes had higher claim frequencies and higher ALP's per IVY than each of the major market classes. All of the subcompact vehicle series summarized had ALP amounts

greater than \$600, whereas only one of the compacts, two of the intermediates and one of the full size vehicle series averages above \$600. In contrast, only one of the subcompacts, one of the compacts, two of the intermediates and one of the full-size vehicle series had claim frequencies of 11 or greater. Detailed results are given which show claim frequency and ALP per claim for each combination of deductible and operator age group for all of the vehicle series from the 25 makes. Totals of 11,887 claims and 116,794 IVY's of exposure were used to compute the claim frequencies. The overall claim frequency was 10.2 claims per 100 IVY's and the standardized claim frequency was 10.7. A total of 10,789 paid claims was used to compute the ALP's. The overall ALP was \$596. Detailed results are also presented for the seven aggregated market classes and for each of the 36 individual series, for each combination of operator age group and deductible category.

Highway Loss Data Inst., Watergate 600, Washington, D.C.
20037
Rept. No. HLDI-R75-1; 1975; 85p
Availability: Corporate author

HS-801 270

FEDERAL MOTOR VEHICLE SAFETY STANDARDS AND REGULATIONS WITH AMENDMENTS AND INTERPRETATIONS ISSUED THROUGH JULY 1974

This reference volume contains procedural rules and regulations covering motor vehicle safety standard (MVSS), including rulemaking, temporary exemptions, manufacturer identification of MVSS related equipment, certification of MVSS equipment, vehicles manufactured in two or more stages, regrooved tires, and vehicle in use inspection standards. Principally this reference contains a listing of MVSS's and amendments on the following: accelerator control systems; brake systems and parts; bus window retention and release; child seating systems; controls and instruments; door locks and retention; exterior protection; flammability of interior materials; fuel tanks and components; glazing materials; head restraints; hood latch systems; driver and occupant impact protection; rearview mirrors; lamps and reflective devices and related equipment; roof crush resistance; seat belts; seating systems; door strength; steering column displacement; theft protection; tires; transmissions; vehicle identification number; warning devices; wheel components; and window and windshield systems. Also included are notices concerning: chassis-cabs; campers (slide-in and chassis-mount); anthropomorphic test dummy specifications; defect reports; tire identification and record keeping; consumer information; defect notification; and odometer disclosure requirements. The regulation on importing motor vehicles and motor vehicle equipment is also given.

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1974; 807p
Availability: GPO

HS-801 521

ANALYSIS OF AUTOMOBILE CRASH TEST DATA AND RECOMMENDATIONS FOR ACQUIRING AND

FILTERING ACCELEROMETER DATA. FINAL REPORT

An attempt is made to define the meaningful frequency content of occupant compartment deceleration data in order to establish effective filtering guidelines which will enhance the important features of the deceleration pulse. Acceleration and displacement spectral distributions of crash test and structural resonance data are compared to assess the presence and effects of resonances in the deceleration time history. A typical accelerometer package-floor pan configuration is modeled to characterize resonant modes associated with current accelerometer package size and mounting. Guidelines are suggested for partitioning data frequency content based on these analyses and also on the comparative effects of high and low frequency decelerations on occupant loading. An alternative method to analog filtering of crash data, which employs a least squared error polynomial curve fitting routine, has been developed and is described. This method has the desired capability to partition the data frequency content into decelerations associated with gross vehicle crush, and residual high-frequency, low displacement amplitude decelerations associated with structural resonances, without discarding any data. Applications of the method to crash test data are presented. Data were obtained from a 1970 Ford impacting an AMF modified Hornet in a side impact test at 25 mph and from another test in which a modified 1970 Ford was subjected to a 50 mph frontal barrier crash. Structural resonance data were obtained. Accelerometer packages were re-installed in the impacting vehicles at the four corner locations of the occupant compartment and the tunnel and engine locations. The structure was excited in the longitudinal direction using a 5 mph bumper pendulum test, and in the vertical direction. Longitudinal and vertical accelerations resulting from the mild structural excitations were measured at all locations and recorded for analysis. The analytical curve fitting and filtering procedure was found to be applicable.

by Frank P. DiMasi
Department of Transportation, Transportation Systems Center,
Kendall Square, Cambridge, Mass. 02142
Rept. No. DOT-TSC-NHTSA-75-2 ; 1975 ; 92p 9refs
Rept. for Jul 1973-Jun 1974.
Availability: NTIS

HS-801 648

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICES SYSTEMS [VOL.1]. FINAL REPORT

by Robert B. Andrews; Louis E. Davis; James R. Bettman; Ronald K. Granit; Kenneth F. Siler
University of California, Los Angeles, Graduate School of Management, 405 Hilgard Ave., Los Angeles, Calif. 90024
Contract FH-11-6849
1975; 566p refs
Rept. for 1 May 1968-29 Feb 1972. See vol. 2 (HS-801 704) and vol. 3 (HS-801 705). 12 Methodologies are developed and demonstrated for the evaluation of existing and proposed systems for delivering emergency medical services (EMS), which are adaptable to a wide variety of situations. An overview is presented examining EMS in terms of the following: a historical perspective; the evolving social, cultural, and technical environments in which they are embedded; how they are viewed by the users, health professionals, and provider organizations; and the forces that tend to facilitate or to inhibit their change. Three kinds of models are presented for the prediction of: the nature and

distribution of demands for EMS; estimates of the operational characteristics; of any proposed EMS system; the kind of illness or injury, its severity, and the probable medical outcomes. Six modifications of existing EMS in the Los Angeles area were demonstrated and their results examined, including benefits and costs where appropriate. No statistically significant difference was found between the use of a mobile intensive care unit (MICU) and an ambulance, in terms of survival rates to the emergency room. The empirical differences in survival rates 90 days after hospital discharge, between victims handled by MICU's and those handled by the ambulances, were statistically significant for the categories of hypertensive and arteriosclerotic heart disease, coma, fainting, dehydration, and metabolic disorders. Helicopter ambulance studies were conducted in three different phases: a response time study; a loading feasibility study; and a patient retrieval demonstration. In the 85 incidents that were studied during the response time segment, the accompanying ground unit arrived on the scene before the helicopter in 80% of the accidents. In the loading feasibility study, landings were made at four selected sites by day and night, yielding a total of 12 flights. Landing data were collected by observers on site and in the helicopter. Police and fire personnel were able to control vehicle traffic and pedestrians. The only serious landing hazard was wires which ground personnel had to be aware of. The helicopter ambulance was shown to be most valuable in providing improved EMS to victims located 15 minutes or more from the nearest ground ambulance. It provided a 30.1% decrease in time of arrival on-scene, and a 22% decrease in arrival time at the most appropriate hospital. The service could be offered at a cost comparable to present ground ambulances, if the helicopter were made available daily and its use continued. A household survey was conducted to explore the following: how citizens view medical emergencies, EMS's and the role of the citizen, during the course of an emergency; the experiences of citizens at the scenes of actual medical emergencies; and what changes citizens want in EMS's. The activities of the overall project had the following impacts on the community: a county paramedic training program was established; MICU's were expanded; the law governing the allowable treatments administered by paramedics was amended; city fire department ambulances were redeployed; the county helicopter ambulance service was continued; the city helicopter ambulance back-up was continued; the programs received wide media coverage; and a county council for coordinating EMS's was created.
Availability: NTIS

HS-801 653

NEAR-TERM SAFETY IMPROVEMENTS FOR MOTORCYCLES, PHASE 2. FINAL REPORT

Three aspects of motorcycle safety are investigated. One explores rider protection in side impacts and the other two relate to accident avoidance. The side impact study contains data and evaluation of nine instrumented crash tests of an automobile into a motorcycle with a dummy rider. The other two studies were of tests for service life of control cables and for improving headlamp illumination. The index used for evaluating the relative hazard of lateral impacts to the head was the Maximum Strain Criterion (MSC). The MSC fatality threshold was generated through the successful use of human volunteer, cadaver, and animal testing. Results were combined using a mathematical model and dimensional analysis. Forces measured on the lower extremities of riders indicated that the injury hazard to the rider decreased appreciably as the impact angle became more oblique. Rear oblique impacts show a lesser degree of hazard to the upper leg than do frontal impacts. The Experimental Safety Motorcycle (ESM) side structure reduced the magnitude of forces measured on both the upper and lower legs of the rider. The highest tibia and femur

loads resulted from 270° impacts. Other conclusions are: 30 mph impacts produced chest accelerations well below fatality thresholds for motorcycle riders; rear oblique impacts resulted in significantly higher accelerations to the chest and head than did the front oblique; 18 to 20 mph appeared to be the fatality threshold for the baseline 270° impacts; and safety bars should be designed to protect the rider's legs up to a 20 mph impact but greater lower protection increases upper body hazard. Tests were conducted on several experimental headlamp lighting systems as well as production systems. The lamps were evaluated from the standpoint of beam pattern, detection, distance, glare, and durability. The following conclusions were reached: dual head lamps systems for motorcycles offer distinct advantages in road illumination and reliability through redundancy; several systems tested were found to provide illumination adequate for safe motorcycle operation at speeds in the 55-60 mph range; none of the headlamp combinations generated glare comparable to car lighting systems; and vibration fatigue appeared not to be the sole factor leading to headlamp filament failures (road shock, ambient temperature range, variable voltages and humidity are possible factors). The cable tests were divided into the following three tasks: establishing the service load for each control cable; testing the cable tensile strength; and evaluating fatigue life. The method for determining brake cable service loads was found to be not comprehensive enough. Trottle, clutch, front brake, and rear brake cables were evaluated. Other findings included: ferrule failure was the predominant mode of failure in both tensile and fatigue test series; new methods of cable end attachment are needed; and it is questionable whether front and rear brake cables can withstand the maximum loads that a 95th percentile male can apply.

by John A. Bartol; G.D. Livers; R. Miennert
AMF Inc., Advanced Systems Lab., 495 South Fairview Ave.,
Goleta, Calif. 93017
Contract DOT-HS-4-00815
1975; 196p
Rept. for 30 Nov 1973-14 Feb 1975.
Availability: NTIS

HS-801 654

REQUIREMENTS ANALYSIS AND FEASIBILITY STUDIES FOR AN EXPERIMENTAL SAFETY MOTORCYCLE. FINAL REPORT

A number of motorcycle subsystems were investigated to determine their relationship to safety. These included aspects of visibility, rear field of view, desirable banking angles, and vehicle dynamics. Specific subsystems investigated were tires, anti-lock brakes, and the fuel system. Security against theft was also analysed. The size and quality of images from six different rear view mirrors under various conditions were measured and evaluated. The problem of mirror vibration was also investigated together with methods for mitigating this condition. A number of methods were tried to increase the visibility of a motorcycle to oncoming and overtaking traffic both by day and night. Daytime visibility was increased by placing high contrast fluorescent panels on the motorcycle. At night, the use of running lights (amber at front, red at rear) was found to be most effective. Eight different motorcycle tires were tested under controlled conditions and their parameters of performance for braking, driving and cornering were evaluated. Results were used as inputs to the vehicle dynamics computer simulation. Some motorcycles have a tendency to wobble at low speeds and weave at high speeds. An investigation of this

problem was made using computer simulation of an Electra Glide motorcycle with a rigid vehicle model developed for other work. Initial results did not show good correspondence between values obtained with the computer for wobble oscillation amplitude and values measured during full-scale testing, indicating a need for other variables such as torsional compliances, non-linearities in the steering system and compliance in the frame. A test vehicle was modified to permit the following three braking modes: conventional front and rear hydraulic systems; anti-lock on front wheel, with conventional rear brakes; and both wheels operated by single control, with anti-lock sensor on the front wheel, and a proportioning valve in the hydraulic brake system. Tests were conducted to evaluate the various systems. The single control, two-wheel anti-lock system showed good to excellent results. An investigation was made of the angle to which various makes of motorcycles are banked when cornered sharply. Experienced riders were shown to bank more than novices. The parts of the motorcycles which grounded first were noted under conditions of turning left, turning right, braking and accelerating. Clearances permitting a 40° bank angle were shown to be desirable. A method for measuring motorcycle cornering clearance by use of a static test procedure was developed. Test procedures were developed and refined for simulating the environment experienced by fuel tanks corresponding to frontal and side collisions with a motorcycle. Test fixtures were built and used to test sample tanks. An automatic fuel shutoff valve was designed and fabricated with the purpose of stopping fuel flow into a carburetor after collision or upset. Multiple security measures were suggested as the best deterrent to motorcycle thefts. An improved switch packaging concept was evolved and described.

by J. A. Bartol; G. D. Livers; R. Miennert
AMF Inc., Advanced Systems Lab., 495 South Fairview Ave.,
Goleta, Calif. 93017
Contract DOT-HS-4-00816
1975; 219p
Rept. for 30 Nov 1973-14 Feb 1975.
Availability: NTIS

HS-801 657

ALCOHOL PUBLIC EDUCATION LITERATURE--ALCOHOL COUNTERMEASURES LITERATURE REVIEW. FINAL REPORT

Literature is reviewed on public information and education in the alcohol and highway accident countermeasures field. Materials furnished or published by the following sources are covered: the National Highway Traffic Safety Administration, the Federal Alcohol Safety Action Projects, the National Institute on Alcohol Abuse and Alcoholism, organizations in the private sector, and the independent evaluation of such programs. It is demonstrated that the use of public information and education is a vital element in the control of the alcohol problem and the drinking driver. The message to be imparted and the approach to be used remain controversial.

by Marvin H. Wagner
National Safety Council, 425 North Michigan Ave., Chicago,
Ill. 60611
Contract DOT-HS-4-00965
1975; 24p 50refs
Rept. for 1973-1974.
Availability: NTIS

HS-801 667

LOWER SPEED LIMITS, REDUCED SPEEDS, FEWER DEATHS--JANUARY - APRIL 1974

The effect of the energy crisis on highway fatalities is studied in terms of lower speed limits and reduced speeds. During January-April 1974, fatal vehicle involvements in 28 states decreased more sharply on high-speed roads (down 29% from the same period in 1973) than on low-speed roads (down 15%). There were substantial reductions in speeds and speeding in fatal involvements in 17 states on all roads during the first four months of 1974. The reduction in speeds took place on low-speed roads (33%) and on high-speed roads (55%). Even the states that did not adopt the 55 mph speed limit until February or March 1974 experienced substantial reductions (31%) in involvements exceeding 55 mph on their high-speed roads prior to adoption. The greatest decline in speeds took place on high-speed roads in the states that had adopted the 55 mph limit (58%). A strong association was found between fatal involvement-speed reduction and fatality reduction. Most of both took place on high-speed roads in states with the 55 mph limit. On high-speed roads in states with the 55 mph limit, February 1974 was the month of greatest fatal-involvement reduction (39%) and high-speed involvement reduction (69%). Thereafter, speeds and fatal involvements crept upwards. On the low-speed roads, speed and fatality reductions were highest in April. The reduction in fatal involvements at 56-75 mph (61%) was twice that above 75 mph (30%) on high-speed roads in January-April 1974. One may infer that the best compliance with the 55 mph speed limit in 1974 came from those drivers who generally obeyed posted speed limits in 1973.

by Charles J. Kahane
National Hwy. Traffic Safety Administration, Office of
Statistics and Analysis

Rept. No. NHTSA-TN-N43-31-6 ; 1975 ; 26p 3refs
Availability: Corporate author

HS-801 707

UNITED STATES NATIONAL REPORT ON CCMS ROAD SAFETY PILOT STUDY FOLLOW-UP

Progress made in implementing the recommendations of the North Atlantic Treaty Organization's Committee on the Challenges of Modern Society's (CCMS) four-year pilot study on traffic safety is reported. The following areas of progress and activity relating to the International Resolution on Road Safety, extracted from the final report by CCMS, are discussed: legislation; National Highway Traffic Safety Administration (NHTSA) annual reports; reduction in total United States traffic fatalities (comparison of fatalities in 1973 and 1974 by class of road user); ad hoc group and program exchange; international cooperation on the part of NHTSA and the Federal Highway Administration (FHWA); and special emphasis programs to be conducted by NHTSA and FHWA. Activities and progress relating to the implementing resolutions on the following topics are discussed: pedestrian safety; alcohol and highway safety; motor vehicle inspection; identification and correction of road hazards; emergency medical services; accident investigation (NHTSA accident research efforts into accident causation, fatal accidents, the role of alcohol in accidents, passive restraints, accident reporting systems, and accident investigation technology); and the experimental safety vehicle program.

National Hwy. Traffic Safety Administration
1975 ; 84p refs
Includes the Road Safety Prog. Personnel List by the country they represent. See also HS-801 135, "United States National Report on CCMS Road Safety Pilot Study."
Availability: Corporate author

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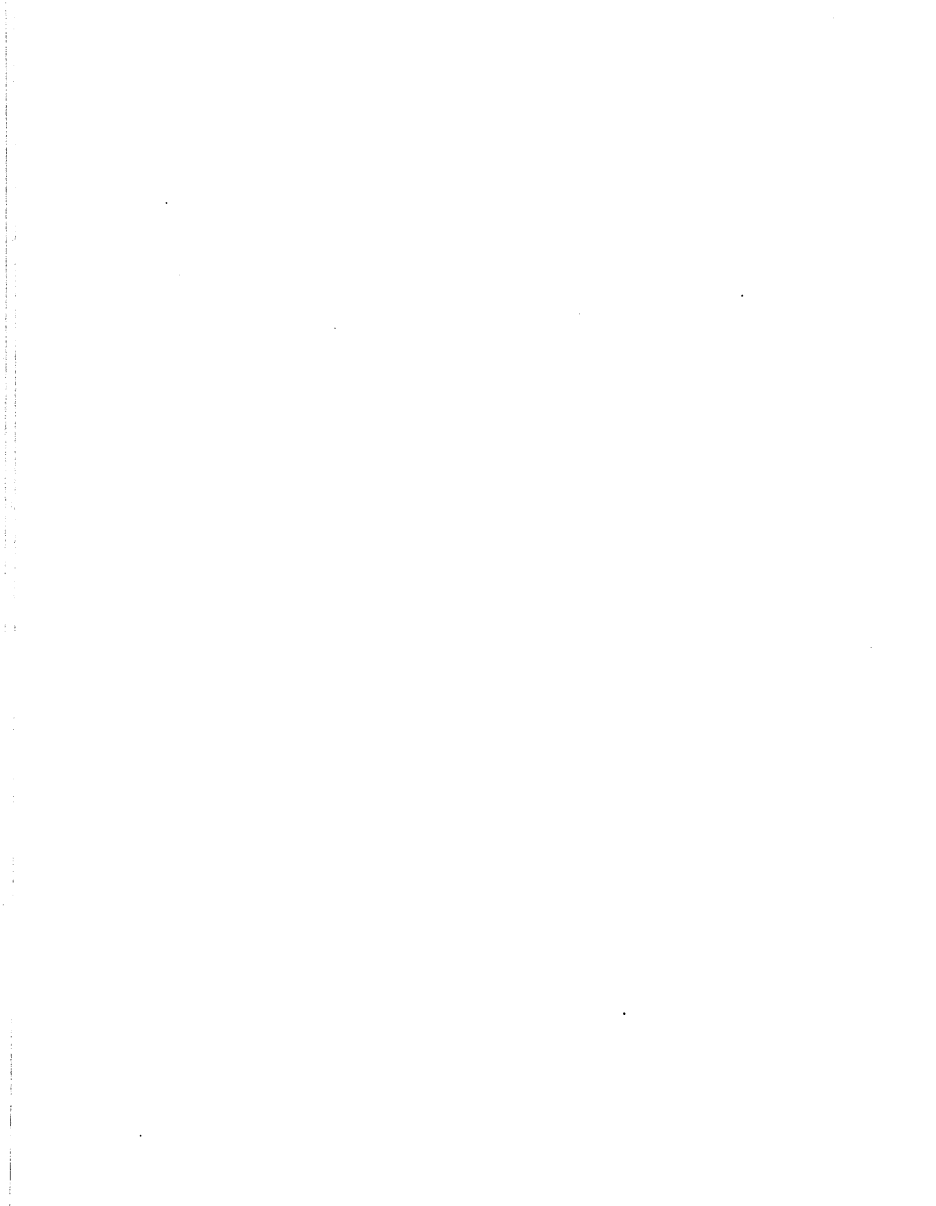
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**Wyoming State Hwy. Dept., Hwy. Safety Branch, P.O.
Box 1708 Cheyenne, Wyo. 82001**

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National Safety Council, 425 North Michigan Ave., Chicago, Ill. 60611

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University of California, Los Angeles, Graduate School of

Management, 405 Hilgard Ave., Los Angeles, Calif. 90024

HS-801 648

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Curtis C. Harris Assoc., Inc., 7008 Wells Pkwy., Hyattsville, Md. 20782

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Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036; RTKL Assoc., Inc.

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Franklin Inst. Res. Labs., Benjamin Franklin Pkwy., Philadelphia, Pa.

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University of California, Inst. of Transportation and Traffic Engineering Berkeley, Calif. 94720

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University of Waterloo, Faculty of Engineering, Ont., Canada

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Rensselaer Polytechnic Inst.

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ECI Systems, Inc., 1050 Massachusetts Ave., Cambridge, Mass. 02138; Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142

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A GUIDE TO REFERENCE SERVICES IN THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

by

Winifred F. Desmond

Chief, Technical Reference Branch, NHTSA

ABSTRACT

The technical reports of a Government agency and its services can help other researchers and the consumer as well as staff. The National Highway Traffic Safety Administration (NHTSA) collects its own reports in one central special library, enriches these reports by an open-literature collection, and makes them available to the public. These collections and services are described.

INTRODUCTION

The organizational element supporting the information needs of NHTSA has been active since 1967. The Administration itself began in 1966 as the National Highway Safety Bureau within the Federal Highway Administration; in 1970 it achieved its present status.

DOCUMENTATION CENTER

In the years 1967 and 1968, the Documentation Center of NHTSA sponsored research to chart the future course of information activity in NHTSA (refs. 1-6). By the time the research reports were published, however, both the reference activity and the bibliography that was later to expand into the abstract journal—*Highway Safety Literature (HSL)*—had gained acceptance in the highway safety research community. They continue today as the major efforts of the Technical Reference Branch, which replaced the Documentation Center.

HIGHWAY SAFETY LITERATURE (HSL)

As a current awareness journal in the field of highway safety, *HSL* began in December 1967 and

has continued since that time. Abstracts were expanded to become increasingly informative, rather than indicative, a trend that is strengthened with the use of a free-language search system. Plans for further expansion of the journal as a medium for the publication of primary research articles is underway.

TECHNICAL REFERENCE BRANCH (TRB)

Concurrent with the development of *HSL* was the growth of reference service which provides the staff with the advantages of a small special library. The scope of the two services, *HSL* and reference, in terms of subject matter is similar. *HSL* directs itself to the research community generally and is freely available to it. The literature it cites is, however, for staff circulation only, with rare exceptions. The information retrieval system by which these citations are retrieved for literature searches and subject bibliographies is available on a subscription basis from the contractor, Informatics, Inc., Rockville, Maryland 20852. The data base itself on magnetic tape may be purchased at cost from NHTSA.

REFERENCE SERVICE

Like *HSL*, the reference arm of TRB addresses itself to the research community generally. Recognizing that staff have needs that go beyond the criteria set for the *HSL* collection, TRB acts to acquire any other publication for staff that is needed to accomplish the aims of the Administration. It also serves as a clearinghouse for the various types of reports generated by staff, so that they can be processed and made easily accessible in an orderly manner. Processing includes numbering, microfiching, possible

selection for *HSL*, and cataloging of each report as quickly as possible. NHTSA documents not available elsewhere are sold in both paper copy and microfiche. All documents in TRB, whether they are cited in *HSL* or whether they fall outside the scope of criteria set for *HSL*, are available for examination in the reading room maintained by the Branch. Since these collections have grown considerably over the years, a brief description of their content, numbering, extent, and retrievability through indexes and catalogs may be of value to TRB users. The outline which follows presents the collections (in various media, including motion picture films and videotapes) under the following headings:

Series Title is the generic term by which the collection is popularly known within the Branch.

Series Prefix and Numbering System identifies each individual document or item as part of a given collection. This number is the shelf locator for the document. In all cases but one these numbers are sequential and have no significance as a subject classification. The exception is the General Reference collection, which is categorized by subject.

Date of First in Series refers to date of publication. Since most items were acquired after 1967, publication dates before that time are the exception.

Approximate Number of Items refers to discrete entities making up the collection. In the case of journals it refers to journal titles. In all cases, it should be considered an estimate only.

Format describes the medium (e.g., paper copy, microfilm) on which the information is stored or presented. In some collections, earlier, less active,

materials are on microfiche, paper copy being retained for more recent entries only. This is indicated by the phrase "paper copy and/or microfiche." Those reports that are available solely through NHTSA can, however, be reproduced at cost in either format on request.

Indexing refers to the catalog, index, or retrieval system whereby subject, author, and other access points are displayed for the user so that documents can be identified by their number, or shelf locator.

Uses of the Collection describes the principal readership based on experience in serving various types of users and identifying their needs. The use of some of the collections is restricted; certain General Reference items, for example, are not permitted to circulate.

LITERATURE SEARCHES

Literature searches of certain collections can be arranged, if appropriate. Search fees are \$6.00 per hour, plus costs for reproduction of documents retrieved as a result of the search. Details of TRB services may be obtained by calling or writing:

Technical Reference Branch (N48-41)
National Highway Traffic Safety Administration
400 7th St. SW
Washington, D.C. 20590
Telephone (202) 426-2768

ACKNOWLEDGMENT

The summary of reference collections which follows was compiled with the cooperation of TRB staff.

REFERENCES

- (1) General Electric Company, Santa Barbara, California. Project Definition Phase Study in the National Traffic Safety Documentation Center. Final Report. April, 1968. (PB-179379, HS-800045)
- (2) Highway Safety Research Institute, University of Michigan, Ann Arbor. Documentation Center. Final Report. May, 1968. 310 pp. (PB-179155, HS-80047)
- (3) Management Technology, Inc., Washington, D.C. A study to implement, test, evaluate, and modify the interim system design. 1968. (PB-180596, HS-80040)
- (4) Safety Management Institute, Washington, D.C. Survey of specialized technical information centers. September, 1968. (PB-180752, HS-800041)
- (5) System Development Corporation, Falls Church, Virginia. National Traffic Safety Documentation Center. Project Definition Study. Final Report. April, 1968. 195 pp. (PB-179156, HS-800046)
- (6) System Development Corporation, Falls Church, Virginia. National Traffic Safety Documentation Center. Project Definition Study. Survey of Users and Sources of Traffic Safety Information. December, 1967. 84 pp. (PB-177701, HS-001921)

<i>Series Title</i>	<i>Series Prefix and Numbering System</i>	<i>Date of First In Series</i>	<i>Approximate Number of Items (as of November 1975)</i>	<i>Format</i>	<i>Indexing</i>	<i>Uses of Collection</i>
I. HIGHWAY SAFETY LITERATURE						
A. Open literature of interest to the research community. Documents include journal articles, monographs, conference proceedings, reports, etc.	HS-000001-017000	Most are dated after 1967	Over 17,000	Paper copy and/or microfiche	On-line retrieval using RECON, a free-language search system. Current awareness via <i>Highway Safety Literature</i> (monthly abstracting journal)	Research-oriented searches of these collections are designed to eliminate duplicative research effort.
B. Technical reports and other publications of NHTSA. Results of contract research and in-house publications are included in this series.	HS-800000-801700	1967	1,700	Paper copy and/or microfiche	<i>Technical Reports of NHTSA; A Bibliography 1967-1975.</i> (HS-801200, PB-236350/AS). A visible file indexed by contractor is also maintained for reference use. On-line retrieval available.	
C. Transportation Research Information Services Network (TRISNET). An information service rather than a conventional collection of documents, it is used to retrieve DOT work in progress, highway research in progress, and other transportation related collections.			39,400	Computer print-out	On-line retrieval (TRIS-ON-LINE) from Battelle Columbus Laboratories.	

Series Title	Series Prefix and Numbering System	Date of First In Series	Approximate Number of Copies
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II. REPORTS FROM PROGRAM AREAS (OTHER THAN RESEARCH AND

A. Standards Enforcement Test Reports

First year 1969, PB-183560; 1969, 7,000
 Issued through National Technical Information Service as PB's. In 1970 and after they appeared in HS-610000-HS-615000
 Federal Motor Vehicle Safety Standards.

yearly through KWIC: HS-611272 (PB-200306) covers reports of 1970; HS-820189 (PB-210436), 1971; HS-820256 (PB-221350), 1972; HS-801663, 1973; 1974, HS-800761.

Monthly news releases are available from Office of Public Affairs and Consumer Services which list Standard Enforcement Test Reports accepted during that month and give summary information about each report.

KWIC Index, current through 1974, is available for reference. This index is identified as HS-801215 (PB-236326/AS)

Microfiche

1,000

First investigations closed and published in 1969 (CIR-26)

CIR

B. Certification Information Requests. Investigations resulting from vehicle or equipment testing for compliance with standards

from other sources, e.g., industry disclosures, news articles and consumer letters.

C. Defects Investigations. Includes all public information related to potential or proven safety related defects: research reports, letters from consumers, transcripts, photographs and other documentary evidence of defects.

1967-1971 reports were cataloged under IR (information requests). From July 1971 cases were cataloged under the following letters: C, referring to a complete investigation; S, a survey; A, an audit. Following the letter is a number designating the fiscal year, then sequential number.

500

Paper Copy and/or microfiche

Card catalog with the following information: manufacturer; vehicle make and model; year; component; possible problem; date case opened, suspended, and closed. Status of case is on cards. Cards are filed by case number, manufacturer, and component.

D. Motor Vehicle Safety Defect Recall Campaigns. Identifies component failure and required corrective action. About 85% constitute voluntary recalls on the part of manufacturer; others result from NHTSA standards enforcement testing and defects investigations (see C). Documents include bulletins containing instructions for corrections, and letters advising consumers of problems.

By year then sequentially.
Sept. 1966

2,000

Detailed reports in paper copy and microfiche

Summaries are issued quarterly (last issue of year is cumulative.) and sold by Superintendent of Documents. Printouts are indexed by manufacturer and component (reference copy only). On-line retrieval system for subject access will soon be operational.

C. Slides. Audiovisuals used by staff members for presentations and materials submitted to supplement con- tract reports.	SP-000001	1970	4000	35mm trans- parencies	<i>Audiovisual Catalog of NHTSA, December 1970- December 1973. HS-801212. (PB-286327/AS)</i>
D. Photographs. Results of compliance testing, experimental safety vehicles, driver education, and con- ference material used by staff members.	SP-000001	1970	200	Glossy prints	<i>Audiovisual Catalog of NHTSA, December 1970- December 1973. HS-801212. (PB-286327/AS)</i>
IV. SPECIFICATIONS					
A. Engineering Spec- ifications (MYMA Passenger Car Specifications and Body Dimensions)					
1. General Motors Corporation	MFD-158 MFD-255 MFD-256	1950-1972 1973 1974 1975		microfilm microfilm microfilm paper copy	Vertical File index 1973 (Reference copy only)
2. Checker Motor Corporation	MFD-253 MFD-256	1973 1974		microfilm microfilm	
3. American Motors Corporation	MFD-114 114-01 MFD-253 MFD-256	1950-1972 1973 1974 1975		microfilm microfilm microfilm paper copy	

Series Title	Series Prefix and Numbering System	Date of First In Series	Approximate Number of Items (as of November 1975)	Format	Indexing	Uses of Collection
4. Chrysler Corporation	MFD-162 MFD-253 MFD-256	1949-1972 1973 1974 1975		microfilm microfilm microfilm paper copy		
5. Ford Motor Corporation	MFD-161 MFD-254 MFD-256	1950-1972 1973 1974 1975		microfilm microfilm microfilm paper copy		
6. Jeep	MFD-114-02	1961-1968		microfilm		
V. DOCKET						
A. The Docket is the public record of rule-making activities for motor vehicle and highway safety standards. A docket begins with a Federal Register notice proposing a new safety standard or an amendment to an old one. It is prepared by NHTSA technical and legal staff. Manufacturers, trade and safety organizations and the general motoring public express their opinions about the proposal by sending their comments to the	Docket No. (now a calendar year plus sequential number)	1966	350 dockets 15,000 entries Total file size approximately 300,000 pages	Older items in microfiche Recent entries in paper copy	Log of entries by Docket maintained for reference. Automation in progress.	The docket is used by manufacturers' representatives, consumers, attorneys and researchers interested in rule-making activities of NHTSA.

docket. In addition technical material pertinent to the matter at hand is submitted to the docket and goes into its General Reference section.

VI. GENERAL REFERENCE

A. Periodicals. Trade journals, research journals, newsletters and other series related to highway safety.	Shelved alpha- betically by title	varies	800	Hard copy and/or microfilm	Serial Record	Provides so- terial for <i>I</i> <i>Safety Lite</i> and research mation for s public.
B. 1. SAE Papers (Society of Automotive Engineers)	650001-	1965	6080	Hard copy and/or microfilm	In <i>HSL</i> , see I.A.	Provides so- terial for <i>H</i> <i>Safety Lite</i> and research mation for s public.
2. Special Papers	SP	varies	65	Paper copy		
	P	varies	175	Paper copy		
3. Recommended Practice	J	varies	1500	Paper copy		
C. Automotive Technical Standard Regulations. Translations of standards from 20 foreign countries.	By country	1967	40 notebooks	Paper copy in looseleaf form	By name of country	
D. Congressional Docu- ments related to highway safety.	USC	July 1956	350	Hard copy and microfiche	Congressional Documents: A Bibliography 1956-1972. DOT-HS-800982. (November 1973)	

<i>Series Title</i>	<i>Series Prefix and Numbering System</i>	<i>Date of First In Series</i>	<i>Approximate Number of Items (as of November 1975)</i>	<i>Format</i>	<i>Indexing</i>	<i>Uses of Collection</i>
E. Vertical File. Materials of a general nature, usually unbound, that are needed for special staff purposes peripherally related to highway safety (e.g., statistics, annual reports, program plans, agenda of meetings).	VF	1967	1750	Microfiche or paper copy	Vertical File Index (Reference copy only)	In general, useful for NHTSA staff only.